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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
60/496,702	08/20/2003	Firooz Ghassabian	676-025c11

CONFIRMATION NO. 6612

FORMALITIES LETTER

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Sofer & Haroun, LLP
Suite 910
317 Madison Avenue
New York, NY 10017

Date Mailed: 10/20/2003

NOTICE TO FILE MISSING PARTS OF PROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(c)

Filing Date Granted

An application number and filing date have been accorded to this provisional application. The items indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $ **80** *to complete the basic filing fee for a small entity.*
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(l) of $25 for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$105** for a Small Entity

- **$80** Statutory basic filing fee.
- **$25** Late oath or declaration Surcharge.

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PART 3 - OFFICE COPY

Effective OCTOBER 1, 2003, Patent Fees will be adjusted. Please note that fee amounts required by the enclosed Notice might reflect the fees due on the date of filing. Any fee paid on or after OCTOBER 1, 2003 is subject to the new FY 2004 fee schedule and must be paid in the new amount.

EXAMPLES OF FEES BEING ADJUSTED
See www.uspto.gov for complete FY 2003 and FY-2004 Fee Schedules

* Indicates fees remain at FY 2003 amount

DESCRIPTION	FY 2003	FY 2004
Basic filing fee - Utility	$750	$770
Basic filing fee - Utility (Small Entity)	$375	$385
Independent claims in excess of three	$84	$86
Independent claims in excess of three (Small Entity)	$42	$43
Claims in excess of twenty	$18	$18*
Claims in excess of twenty (Small Entity)	$9	$9*
Multiple dependent claim	$280	$290
Multiple dependent claim (Small Entity)	$140	$145
Surcharge - Late filing fee	$130	$130
Surcharge - Late filing fee (Small Entity)	$65	$65
Design filing fee	$330	$340
Design filing fee (Small Entity)	$165	$170
Plant filing fee	$520	$530
Plant filing fee (Small Entity)	$260	$265
Reissue filing fee	$750	$770
Reissue filing fee (Small Entity)	$375	$385
Reissue independent claims	$84	$86
Reissue independent claims (Small Entity)	$42	$43
Reissue claims in excess of twenty	$18	$18*
Reissue claims in excess of twenty (Small Entity)	$9	$9*
Provisional application filing fee	$160	$160*
Provisional application filing fee (Small Entity)	$80	$80*
Surcharge - Late provisional filing fee	$50	$50*
Surcharge - Late provisional filing fee (Small Entity)	$25	$25*
Non-English Specification	$130	$130*
Extension - First month	$110	$110*
Extension - First month (Small Entity)	$55	$55*
Extension - Second month	$410	$420
Extension - Second month (Small Entity)	$205	$210
Extension - Third month	$930	$950
Extension - Third month (Small Entity)	$465	$475
Extension - Fourth month	$1,450	$1,480
Extension - Fourth month (Small Entity)	$725	$740
Extension - Fifth month	$1,970	$2,010
Extension - Fifth month (Small Entity)	$985	$1,005
Petition	$130	$130*
Processing returned checks	$50	$50*

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(703-308-HELP)

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16085 U.S. PTO
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PTO/SB/16 (05-03)
Approved for use through 4/30/2003. OMB 0651-0032
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21901 U.S. PTO
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08/20/03

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV342253012US

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Firooz	Ghassabian	Great Neck, NY

Additional inventors are being named on the _____ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

METHOD OF DATA ENTRY COMBINING KEY PRESS & SPEECH

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ Customer Number [ ] → Place Customer Number Bar Code Label here

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[X] Firm or Individual Name	Sofer & Haroun, LLP				
Address	317 Madison Avenue, Suite 910				
Address					
City	New York	State	NY	ZIP	10017
Country		Telephone	2126972800	Fax	

ENCLOSED APPLICATION PARTS *(check all that apply)*

[X] Specification *Number of Pages* 109 ☐ CD(s), Number

[X] Drawing(s) *Number of Sheets* 55 ☐ Other (specify)

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

[X] Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees.

☐ The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number:

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

FILING FEE AMOUNT ($): $80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[X] No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

[Page 1 of 2]

Respectfully submitted,

SIGNATURE _____

TYPED or PRINTED NAME Joseph Sofer, Esq.

TELEPHONE 212-697-2800

Date 8/20/2003

REGISTRATION NO. *(If appropriate)* 34,438

Docket Number: 676-025c11

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. 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 8 hours 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Provisional Application, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PATENT Docket No. 676-025c11

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s)	:	Ghassabian
Serial No.	:	TBA
Filed	:	August 20, 2003
For	:	METHOD OF DATA ENTRY COMBINING KEY PRESS & SPEECH

EXPRESS MAIL CERTIFICATE

Express Mail Label No. EV342253012US

Date of Deposit August 20, 2003

I hereby certify that the following attached paper(s) or fee

1) Provisional Patent Application (109 sheets)
2) Patent Transmittal
3) Informal Drawings (55 sheets)
4) Return Postcard
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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 Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Sandria Cirillo
(Signature of person mailing paper(s) or fee)

Mailing Address:
SOFER & HAROUN, LLP
317 Madison Avenue, Suite 910
New York, New York 10017
Tel:(212) 697-2800; fax (212) 697-3004

PROVISIONAL PATENT APPLICATION

FOR

METHOD OF DATA ENTRY COMBINING KEY PRESS & SPEECH

Inventors: Benjamin Firooz Ghassabian

Title:

A MICROPHONE FOR DATA ENTRY USING INTEGRATED KEYPAD SYSTEMS

Specification:

The invention described hereafter relates to method of configuration of symbols such as characters, punctuation, functions, etc. (e.g. symbols of a computer keyboard) on a small keypad having a limited number of keys, for data entry in general, and for data and/or text entry method combining voice/speech of a user and key interactions (e.g. key presses) on a keypad, in particular. This method facilitates the use of such a keypad.

Fig. 1, shows an example of an integrated keypad 100 for a data entry method using key presses and voice/speech recognition systems. In this example, the keys of the keypad may respond to one or more type of interactions with them. Said interactions may be such as:

- pressing a key with a specific finger or a portion of a finger (using a finger recognition system)
- a single tap (e.g. press) on a key or a double tap (e.g. two consecutive presses with short time interval) on a key.
- a slight pressure (or a touch) on a key, or a heavy pressure on a key
- a short time interaction with a key (e.g. a short time pressing of a key) or a longer time pressing of a key etc...

To each of said interactions or to any combination of them with the keys of the keypad, a group of symbols on said keypad may be assigned. For example, the symbols shown on the top side of the keys of the keypad 100, may be assigned to a single pressure on the keys of the keypad. If a user, for example presses the key 101, the symbols "DEF3 ." may be selected. In the same example, the symbols configured on the bottom side of the keys of the keypad 100, may be assigned for example, to a double tap on said keys. If a user, for examples double taps on the key 101, then the symbols " { }' " are selected.

Same selection may also be possible with other interactions such as those described before depending on the system implemented with the keys of the keypad. For example, a slight press (or a touch) on the key 101, could select the symbols configured on the top side of said key, and a heavier pressure on the same key, could select the symbols configured on the bottom side of said key.

As described, when a user interacts with a key, a recognition system candidates the symbols on said key which are assigned to said type of interaction. For example, if a user touches or slightly presses the key 102, the system candidates the symbols, "A", "B", "C", "2", and ",". To select one of said candidated symbols, said user may speak, for example, either said symbol or a position appellation of said symbol on said key. For this purpose a voice/speech recognition systems is used.

If the user does not speak, a predefined symbol among those candidated symbols, may be selected as default. In this example, the punctuation "," shown

in a box 103 is selected. To select one of the other candidated symbols, for example the letter "B", the user may speak said letter.

In the same example, if the user presses heavily the key 102, then the symbols "[", "]", and """" may be candidated. As described above, if the user does not speak, a predefined symbol among those selected by said pressing action, may be selected as default. In this example, the punctuation """" is selected. Also in this example, to select a desired symbol among the two other candidated symbols "[", or "]", the user may use different methods such as speaking said desired symbol, and/or speaking its position relating to the other symbols, and/or speaking its color (if each symbol has a different color), and/or any predefined appellation (e.g. a predefined voice or sound generated by a user) assigned to said symbol. For example, if the user says "left", then the character "[" is selected. If the user says "right", then the character "]" is selected.

Of course, instead of using a voice/speech, a behavior of a user combined with a key interaction may select a symbol. For example, a user may press the key 102 heavily and swipe his finger towards a desired symbol.

The above-mentioned method of data entry may also be applied to a keypad having keys responding to a single type of interaction with said keys (e.g. a standard telephone keypad having push-buttons). As shown in Fig. 2, a keypad 200 having keys responding to a single interaction with said keys. When a user presses a key all of the symbols on said key are candidated by the system. For example, if the user presses the key 202, then the symbols, "A", "B", "C", "2", ",", "[", " ", and "]" are canditated.

In this example, if the user does not speak, the system may select a predefined default symbol. In this example, punctuation "," 203 is selected.

Still in the same example, to select a desired symbol among the said candidates, the user may either speak a desired symbol, or for example, speak a position appellation of said symbol, on said key or relating to other symbols on said key, or any other appellation as described before. For example, a symbol among those configured on the top of the key (e.g. "A", "B", "C", or "2"), may be selected by speaking it. In other hand, for example, one of the symbols configured on the bottom side of the key, (e.g. "[", " ", or "]") may be selected by speaking its position relative, for example, to the two other symbols on the bottom side of said key, by saying for example, "left", "middle, or "right". For example, to select "[" 204, the user may press the key 202 and say "left".

As mentioned, the keys the keypad of fig.1, may respond to at least two predefined types of interactions with them. Each type of interaction with a key of said keypad may candidate a group of said characters on said key.

As described before, during a data entry such as writing a text, different interactions with the keys (e.g. one tap, double tap) and different user behavior (e.g. speaking, not speaking) combined with said key interactions, may be required. Although the data entry method of this invention is a quick and easy data entry, a good configuration of the symbols on the keys of the keypad of this invention, may result a still easier and quicker data entry system. This method will be described hereafter.

According to one embodiment, as shown in fig. 3, a number of symbols (e.g. symbols on a computer keyboard) are physically divided into at least two groups and arranged on a telephone keypad keys by their order of priority (e.g. frequency of use, familiarity of the user with existing arrangement of some symbols such as letters and digits on a standard telephone keypad, etc.), as follow:

<u>First group assigned to a first type of interaction with a keys</u>

a) ***A first subgroup using voice/speech***

Digits 0 – 9, and letters A-Z may be placed on the keys of a keypad according to standard configuration and assigned to a first type of interaction (e.g. a first level of pressure) with said keys. A desired symbol among them may be selected by interacting (e.g. said first type of interaction) with a corresponding key and naturally speaking said symbol. In fig. 3 said symbols (e.g. 301) are configured on the top side of the keys.

Letters and digits may frequently be used during, for example, a text entry. They both, may naturally be spoken while, for example, tapping on corresponding keys. Therefor, for faster and easier data entry, they preferably may be assigned to a same type of interaction with the keys of a keypad.

b) *A second subgroup not using voice/speech*

At least part of the other symbols (e.g. punctuation, functions, etc.) which are frequently used during a data (e.g. text) entry may be placed on the keys (one symbol per key) of the keypad and be assigned to said first type of interaction (e.g. a single tap) with said keys. As default, a desired symbol may be selected by only said interaction with corresponding key without the use of speech/voice. In fig. 3 said symbols (e.g. 302) are configured in boxes on the top side of the keys.

Of course, said symbols may also be selected by speaking them while interacting with a corresponding key, but because speaking this kind of symbols (e.g. punctuation, functions) is not always a natural behavior, it is preferable to not to speak them.

At least a second group assigned to at least a second type of interaction with at least one key

At least part of the remaining symbols may be assigned to at least a second type of interaction with said keys of said keypad. They may be divided into two groups as follow:

c) A third subgroup not using voice/speech

A third subgroup comprising the remaining frequently used symbols and the ones which are difficult and/or not natural to pronounce, may be placed on said keys of said keypad (one symbol per key) and assigned to a second type

of interaction (e.g. double tap, heavier pressure level, two keys pressed simultaneously, a portion of a finger by which the key is touched, etc.) with said keys.

As default, a desired symbol may be selected by only said interaction with a corresponding key without the use of speech/voice. In fig. 3 said symbols (e.g. 303) are configured in boxes on the bottom side of the keys.

Of course, said symbols may also be selected by speaking them while interacting with a corresponding key, but because speaking this kind of symbols (e.g. punctuation, functions) is not always a natural behavior, it is preferable to not to speak them.

d) At least a fourth subgroup using voice/speech

A fourth subgroup comprising at least part of remaining symbols may also be assigned to said second type of interaction with the keys of said keypad and be combined with a user's behavior such as voice. In fig. 3 said symbols (e.g. 304) are configured on the bottom side of the keys. Said symbols may be selected by said second type of interaction with a corresponding key and use of voice/speech in different manners such as:

- the symbols being selected by naturally pronouncing their appellation
- the symbols being selected by naturally speaking their position relative to each other on a key or their position while using them in a text (e.g. "<", ">" in this example, said symbols do not belong to said second type

of interaction, this is only an example), by saying for example, "left, right, open, close, etc."

- the symbols which are very rarely used (they are very few) and/or are difficult to pronounce (e.g. 304). For a fast and easy data entry method, said symbols may also be selected by speaking their position on a key, or relative to each other on said key. Of course they be selected by using other speech such a pronouncing them.

e) Others

If needed, other symbols such as "F1-F12", etc. may be provided on the keys of the keypad and assigned a type of interaction. For example, they may be assigned to said second type of interaction (with or without using speech), or be assigned to another kind of interaction such as pressing two keys simultaneously, triple tagging on corresponding key(s), using a switch to enter to another mode, etc.

More considerations to enhance the keypad and the use of it

Because Digits 0 – 9, and letters A-Z may be placed on the keys of a keypad according to standard configuration and be assigned to a first type of interaction (e.g. a first level of pressure, a single tap, etc.) with said keys combined with speech, some keys such as 311, 312, 313, and 314, may contain at most one symbol (e.g. digit 1 on the key 311, or digit 0 on the key 313) used in

said configuration. Thus for better use of said keys, some easy and natural to pronounce symbols 321-324 may be added on said keys and be assigned to said first type of interaction. for example, a user can select the character "(" by using a first type of interaction with key 311 and saying, for example, "left", or "open". To select the character ")" the user may use the same first type of interaction with said key 311 and say for example, "right" or "close". This is a quick, and more importantly a natural speech for said symbols. Because the number of candidated symbols on said keys 311-314, assigned to said first type of interaction does not exceed the ones on the other keys, the voice recognition system may still have a similar degree of accuracy as for the other keys.

Also, some symbols may be used in both modes (interactions with the keys). Said symbols may be configured more than once on a keypad (e.g. either on a single key or on different keys) and be assigned to a first and/or to a second type of interaction with corresponding key(s).

Fig.3, illustrates a preferred embodiment of this invention for a computer data entry system. The keys of the keypad 300 respond to two or more different interaction (such as different levels of pressures, single or double tap, etc.) on them. As shown, a number of symbols, such as alphanumerical characters, punctuations, functions, and PC command are distributed among said keys as follow:

<u>Mode 1</u>

First group- Letters A-Z and digits 0-9 are the symbols which are very frequently used during a data entry such as writing a text. They may easily and most importantly, naturally, be pronounced while pressing corresponding keys. Therefor they are arranged together on the same side on the keys, belonging to a same type of interaction (e.g. a first mode) such as a single tap (e.g. single press) on a key, and are selected by speaking them.

Second group- Characters such as punctuations, and functions which are very frequently used during a data entry such as writing a text, may belong to a same type of interaction which is used for selecting said letters and digits (e.g. said first mode). This is to stay, as much as possible, with a same type of interaction with the keys while entering data. Each key may only have one of said characters of said second group. This group of symbols may be selected by only pressing a corresponding key, without using voice. For better distinction, they are shown in boxes on the top (e.g. same side as for the letters and the digits) of the keys.

<u>Mode 2</u>

Other symbols of said number of symbols are shown on the bottom side of the keys of the keypad. They are assigned to a second type of interaction (e.g. double tap) with said keys.

Third group- The default symbols (e.g. those which require an interaction with a key and may not require use of voice) are shown in boxes. Said

symbols comprise characters, punctuations, functions, etc., which are less currently used by users.

Fourth group- Finally the symbols which are rarely used in a data entry, and are not spelled naturally, are in this example, located at the left side on the bottom side of the keys. They may be selected by corresponding interaction (e.g. double tapping) with corresponding key and either (e.g. almost simultaneously) pronouncing them, or calling them by speaking a predefined speech or voice assigned to said symbols (e.g. "left, right", or "blue, red" etc.).

By using a keypad having keys corresponding to different type of interaction with them (preferably two types, to not complicate the use of the keys) and having some symbols which do not require speech (e.g. defaults), when a key of said keypad is interacted, either a desired key is directly interacted (e.g. default), or the candidated symbols to be selected by a user behavior such as voice/speech are minimal. This augments the accuracy of voice recognition system.

For example, when a user slightly presses a key, the system selects the symbols on the top of said key among those symbols situated on said key. If the user simultaneously uses a voice, then the system selects those symbols requiring voice among said selected symbols. This procedure of reducing the number of candidates and requiring voice recognition technology to select one of them, is used to have a data entry with high accuracy through a keypad having a limited

number of keys. The reducing procedure is made by user natural behaviors, such as pressing a key and/or speaking.

As shown in fig.4, the keys 411, 412, 413, and 414, have up to one symbol (shown on the top side of said keys) requiring voice interaction and assigned to a first type of interaction with said keys. On the other hand, same keys on the bottom side contain two symbols which require a second type of interaction with said keys and also requires voice interaction. Said two symbols may be used more frequently (e.g. in an arithmetic data entry or when writing a software, etc.) than the other symbols belonging to same category. In this case and to still minimize the user errors while interacting with keys (e.g. pressing), said symbols may also been assigned to said first type of interaction with said keys. The total of the candidated symbol remains low. A user may press said key as he desires and speak.

Additional arrangements may be provided on above-mentioned keypad to facilitate its use by a user. For example, "-" and "_", "“”" and "'", or ";" and ":" may be configured as default symbols on a same key 411, or on two neighboring keys 415, 416. Also "Sp" and " " (e.g. Tab), may also be considered as default symbols and been configured on the same key 412, each responding to a different type of interaction (e.g. pressing level) with said key. For example, by pressing once the key 412, the character "Sp" is selected. By double tapping the same key, the "tab" function is selected.

While interacting with a key (e.g. pressing a key once or double tagging on it), by not releasing said key, a symbol corresponding to said interaction

(including speech if needed) may be selected and repeated until the key is released. For example, by double tapping on the key 415 and keeping the key pressed after the second tap and not speaking, the default symbol (e.g. "&") assigned to said interaction is selected and repeated until the user releases said key. To enter the letter "X" and repeating it, the user may for example, press the corresponding key 415 (without releasing it) and say "X". The letter "X" will be repeated until the user releases said key.

Also, for a more familiar look of the keypad, letters, digits, and characters such as "#" and "*", may be placed on said keys according to a standard telephone keypad configuration.

Additional keys separately disposed from the keys of said keypad may be used to contain some of said symbols or additional symbols. In the example of Fig. 6, the cursor is navigated in different directions by at least one key separately disposed from the keys of the keypad 600. A single key 601, may be assigned to all directions 602. The user may, for example, press said key and say "up, down, left, or right to navigate the cursor in corresponding directions. The key 601, may also be a multi-directional key (e.g. similar to those used in video games, or in some cellular phones to navigate in the menu). The user may press on the top, right, bottom, or left side of the key 601, to navigate the cursor accordingly. Also a plurality of additional keys may be assigned, each to for example, to at least a symbol such as " ".

Said additional keys may be the existing keys on an electronic device. For example, in a cellular phone, in addition to the twelve keys of a standard

telephone keypad, additional function keys such as menu key, or on/of key etc., are provided. at least some of those keys may be used as additional data entry keys, containing a number of symbols, while the system is, for example, in a text entry mode. This frees some spaces on the standard telephone keypad keys. The freed spaces may permit a better accuracy of voice recognition system and/or a more user friendly configuration of the symbols on the keys of the keypad.

The above-mentioned method of configuration and the examples shown before are only shown as examples. Of course many other configurations of the symbols and different assignment to different user interactions with the keys may be considered. For example, a key may not have a default symbol or on a key, there may be no symbols which are assigned to a voice/speech.

Also not all of the keys of the keypad may respond to a same kind of interaction. For example, a first key of a keypad may respond to two levels of pressure while another key of the same keypad may respond to a single or double tap on it.

Figs. 1-7 show different configurations of the symbols on the keys of keypads.

The above-mentioned data entry system permits a full data entry such as a full text data entry through a computer keypad. By inputting, one by one, characters such as letters, punctuation marks, functions, etc, words, and sentences may be inputted.

This will have a great impact on telecommunication market permitting to enhance many applications and methods already in use. Some of them are listed hereafter.

It is understood that any combination of the above-mentioned interactions may be used for inputting a desired symbol.

According to one embodiment of the invention, the user uses voice/speech to input a desired symbol such as a letter without other interaction such as pressing a key. The user may use the keys of the keypad (e.g. single press, double press, triple press, etc) to enter symbols such as punctuations without speaking them.

It is understood that the data entry method described in this application may be applied to all other languages such as Chinese, Koreans, Japanese, Etc.

Correction and Repeating of Symbols

Different methods may be used to correct an erroneously entered symbol. As mentioned, to enter a symbol, a user for example, may press a corresponding key and speak said desired symbol configured on said key. It may happen that the voice/speech recognition system misinterprets the user's speech and the system selects a non-desired symbol configured on said key.

For example, if the user:

a) recognizes an erroneously entered symbol before entering a next desired symbol (e.g. the cursor is positioned after said erroneous symbol, next to it), he then may proceed a correction procedure explained hereafter;

b) recognizes an erroneously entered symbol after entering at least a next symbol, he first may navigate in the text by corresponding means such as the key 101 (fig.1), or 202 (fig.2), having navigation functions, and positions the cursor after said erroneous symbol next to it. He, then, proceeds to a correction procedure explained hereafter;

After positioning the cursor after said erroneous symbol, next to it, the user may re-speak either said desired symbol or its position appellation without re-pressing said corresponding key. If the system again selects the same deleted symbol, it will automatically reject said selection and selects a symbol among remaining symbols configured on said key, wherein either its appellation or its position appellation corresponds to next highest probability corresponding to said user's speech. If still an erroneous symbol is selected by the system, the procedure of re-speaking the desired symbol by the user and the selection of the next symbol among the remaining symbols on said key with highest probability, may continue until said desired symbol is selected by the system.

It is understood that in a data entry system using a keypad having keys responding, for example, two levels of pressure, when correcting, the recognition

system may first proceed to select a symbol among those belonging to the same group of symbols belonging to the pressure level applied for selecting said erroneous symbol. If none of those symbols is accepted by the user, then the system may proceed to select a symbol among the symbols belonging to the other pressure level on said key.

Fig. 7B, shows a flowchart corresponding to an embodiment of a method of correction. If for any reason a user wants to correct an already entered symbol, he may enter this correction procedure.

Correction procedure starts at step 3000. If the replacing symbol is not situated on the same key as the to-be-replaced symbol 3010, then the user deletes the to-be-replaced symbol 3020, and enters the replacing symbol by pressing a corresponding key and if needed, with added speech 3030 and exits 3110.

If the replacing symbol is situated on the same key as the to-be-replaced symbol 3040, and the replacing symbol does not require speech 3050, then the system proceeds to steps 3020 and 3030, and acts accordingly as described before, and exits 3110.

If the replacing symbol is situated on the same key as the to-be-replaced symbol 3040, and the replacing symbol does require speech 3060, two possibilities are considered:

a) the cursor is not situated after the to-be-replaced symbol 3070. In this case the user positions the cursor after the to-be-replaced symbol, next to it 3080, and proceeds to next step 3090;

b) the cursor is situated after the to-be-replaced symbol 3070 (e.g. the user recognizes an erroneously entered symbol, immediately). In this case the user proceeds to next step 3090;

At the step 3090, the user speaks the desired symbol without pressing a key. By not pressing a key and only speaking, the system understands that a symbol belonging to a key which is situated before the cursor must be replaced by another symbol belonging to the same key. The system then, will select a symbol among the rest of the symbols (e.g. excluding the symbols already selected) on said key with highest probability corresponding to said speech 3100. If the new selected symbol is yet a non-desired symbol 3110, the system (and the user) re-enters at the step 3090. If the selected symbol is the desired one the system exits the correction procedure 3120.

Of course, instead of the above-mentioned method, a conventional method of correcting a symbol may also be provided. for example, to correct an already entered symbol, the user may simply, first delete said symbol and then re-enter a new symbol by pressing a corresponding key and if needed, with added speech.

The text entry system, may also be applied to a word level (e.g. the user speaks a word and types it by using a keypad). A same text entry procedure may combine word level entry (e.g. for words contained in a data base) and character level entry. Therefore the correction procedure described above, may also be applied for a word level data entry.

For example, to enter a word a user may speak said word and press the corresponding keys. If for any reason such as disambiguity between two words having closed pronunciation and similar key presses, the recognition system selects a non-desired word, then the user may re-speak said desired word without re-pressing said corresponding keys. The system then, will select a word among the rest of candidates words corresponding to said key presses (e.g. excluding the words already selected) with highest probability corresponding to said speech. If the new selected word is yet not the desired one, the user may re-speak said word. this procedure may be repeated until either said desired word is selected by the system or there is no other candidate word. in this case, the user can enter said desired word by character by character entry system such as the one explained before.

It is understood that in word level, when correcting, the cursor should be positioned after said to-be-replaced word. For this purpose and for avoiding the ambiguity with character correction mode, when modifying a whole word (word correcting level), the user may position the cursor after said to-be-replaced word wherein at least one space character separates said word and said cursor. This is because for example, if a user wants to correct the last character of an already entered word, he should locate the cursor immediately after said character. By positioning the cursor after at least one space after the word (or at the beginning of the next line, if said word is the last word of the previous line), and speaking without pressing keys, the system recognizes that the user may desire to correct the last word before the cursor. For better result, it is understood that if the to-be-

replaced word contains a punctuation mark (e.g. "." "?" "," etc.), the cursor may be replaced after an space after the punctuation mark. This is because in some cases the user may desire to modify an erroneous punctuation mark which must be situated at the end of a word. For this purpose the user may position the cursor next to said punctuation mark.

To avoid accidental corrections (e.g. the cursor is positioned somewhere in the text and someone speaks without intending a data entry), different methods may be applied. For example, a pause or non-text key may be used while a user desires for example, to rest during a text entry. Another solution is that after the cursor is positioned in a location in a text, after a laps of time (for example two seconds) no correction of the last word or character before the cursor is accepted by the system. If a user desires to correct said word or said character he may, for example, navigate said cursor (at least one move to any direction) and bring it back to said desired position. After the cursor is repositioned in the desired location, the time will be counted from the start and the user should start correcting said word or said character before said laps of time is expired.

Repeating a symbol

To repeat a desired symbol, the user, first presses the corresponding key and if required either speaks said symbol, or he speaks the position appellation of said symbol on its corresponding key or according to other symbols on said key. The system then selects the desired symbol. The user continues to press said key

without interruption. After a predefined laps of time, the system recognizes that the user indents to repeat said symbol. The system repeats said symbol until the user stops pressing said key.

It should be noted that the above described method of correction and repeating of key symbol can be used in conjunction with any method of entry including but not limited to single/double tap, pressure sensitive keys, keys pressed simultaneously, keys pressed on only a potion thereof etc.

Telephone directory

To make a phone call, instead of dialing a number, a user may enter a to-be-called destination by any information such as name (e.g. person, company, etc.) and if necessary enter more information such as the said to-be-called party address, etc. A central directory, may automatically direct said call to said destination. If there are more than one telephone lines assigned to a said destination (e.g. party), or there are more than one choice for said desired information entered by the user, a corresponding selection list (e.g. telephone numbers, or any other predefined assignments assigned to said telephone lines) may be transmitted to the caller's phone and displayed for example, on the display unit of his phone. Then the user may select a desired choice and make the phone call.

The above-mentioned method of calling (e.g. dialing), may permit to eliminate the need of calling a party (e.g., a person) by his/her telephone number.

Therefor may eliminate (or at list reduces) the need of remembering phone numbers, carrying telephone books, or using an operator's aid.

Interactive directories using voice/speech

Voice directories are more and more used by companies, institutions, etc. This method of interaction with another party is a very time consuming and frustrating procedure for the users. Many people, by hearing a voice directory on the other side of the phone, disconnect the communication. Even when a person tries to interact with said system, it frequently happens that after spending plenty of time, the caller does not succeed to access a desired service or person. The main reason for this ambiguity is that when listening to a voice directory indication, many times a user must wait until all the options are announced. He (the user), many times does not remember all choices which were announced. He must re-listen to those choices.

Also many times the voice directory demands a data to be entered by a user. This data entry is limited in variation because of either the limited number of keys of a telephone keypad or the complexity of entering symbols through it.

The above-mentioned data entry method permits a fast visual interaction with a directory. The called party may transmit a visual interactive directory to the caller and the caller may see all choices almost instantly, and respond or ask questions using his telephone keypad (comprising the above-mentioned data entry system) easily and quickly.

Voice mails

Voice mails may also be replaced by text mails. This method is already in use. The advantage of the method of data entry described above is evident when a user has to answer or to write a massage to another party. The data entry method of the invention is also dramatically enhances the use of massaging systems through mobile electronic devices such as cellular phones. One of the most known use is in the SMS.

The number of electronic devices using a telephone-type keypad is immense. The data entry method of this invention permits a dramatically enhanced data entry through the keypads of said devices. Of course this method is not limited to a telephone-type keypad. It may be used for any keypad wherein at least a key of said keypad contains more than one symbol.

Multi-sectioned keypad

The size of a keypad using the above-mentioned data entry method, may still be minimized by using a keypad having multiple sections. Said keypad may be minimal in size (e.g. as large as the largest section, for example as large as of the size of an adult user's fingertip or the size of a small keypad key) in a closed position, and maximized as desired when the keypad is in open position (depending on the number of sections used and/or opened).

Theoretically, in closed position, the keypad may even have the size of a key of said keypad.

Fig 8 shows one embodiment of said keypad 800 containing at least three sections 801, wherein each of said sections contains one column of the keys of a telephone keypad. When said keypad is in open position, a telephone-type keypad 800 is provided. In closed position 802 said keypad may have the width of one of said sections.

Another embodiment of said keypad is shown in fig. 9. Said keypad 900 contains at least two sections 901-902 wherein a first section 901 contains two columns 911-912 of the keys of a telephone-type keypad, and a second section 902 of said keypad contains at least the third column 913 of said telephone-type keypad. When said keypad is in open position, a telephone-type keypad is provided. Said keypad, may also have an additional column 914 of keys arranged on said second section. In closed position 920 said keypad may have the width of one of said sections.

As shown in fig. 10, another embodiment of said keypad 1000 contains at least four sections 1001-1004 wherein each of said sections contains one row of the keys of a telephone keypad. When said keypad is in open position, a telephone-type keypad is provided. In closed position 1005 the length of said keypad may the size of the width of one row of the keys of said keypad.

Fig. 11 shows another embodiment of said keypad 1100 containing at least two sections 1101-1102 wherein a first section contains two rows of the keys of a telephone-type keypad, and a second section of said keypad contains

the other two rows of said telephone-type keypad. When said keypad is in open position, a telephone-type keypad is provided. In closed position 1103, the length of the keypad may be as the size of the width of one row of the keys of said keypad.

The above-mentioned multi-sectioned keypad has already been described in patent applications already filed by the inventor.

By using the above-mentioned data entry method through a multi-sectioned keypad as described, a miniaturized easy to use full data entry keypad may be provided. Such keypad may be used in many device, specially those having a limited size.

Of course, the above-mentioned symbol configuration may be used on said multi-sectioned keypad.

Fig. 12 shows another embodiment of a multi-sectioned keypad 1200. The distance between the sections having keys 1201 may be increased by any means. For example, empty (e.g. not containing keys) sections 1202, may be provided between the sections containing keys. This will permit more enlarged the distance between the sections when said keypad is in open position. In other hand, it also permits to have a still thinner keypad in closed position 1203.

<u>A data entry device having integrated keypad and mouse or point and click device</u>

To enhance the data entry method through a keypad in general and through the keypad of this invention in particular, a point and click system, hereinafter a mouse, can be integrated in the back side of an electronic device having a keypad for data entry in its front side.

Fig. 13, shows an electronic device such a cellular phone 1300 wherein a user holds in palm of his hand 1301. Said user may use only one hand to hold said device 1300 in his hand and in the same time manipulate its keypad 1303 located in front, and a mouse or point and click device (not shown) located on the backside of said device. The thumb 1302 of said user may use the keypad 1303, while his index finger 1304 may manipulate said mouse (in the back). Three other fingers 1305 may help holding the device in the user's hand.

The mouse or point and click device integrated in the back of said device may have similar functionality to that of a computer mouse. Also several keys (e.g. two keys) of either the telephone-type keypad or among the additional keys of said device may be assigned to the mouse click functions. for example, keys 1308 and 1318 may function with the integrated mouse of said device 1300 and have the similar functionality of the keys of a computer mouse. Said keys may have the same functionality as the keys of a computer mouse. For example, by manipulating the mouse, the user may navigate a Normal Select (pointer) indicator 1306 on the screen 1307 of said device and position it on a desired menu 1311. As for a computer mouse, said user then, for example, may tap (click) or double tap (double click) on a predefined key 1308 of said keypad

(which is assigned to the mouse) to for example, select or open said desired menu 1311which is pointed by said Normal Select (pointer) indicator 1306.

Because the display of mobile devices such as cellular phones has a small size, a rotating button 1310 may be provided in said device to permit to a user to, for example rotate the menu lists. For example, after a desired menu 1311 appears on the screen 1307, a user may use the mouse to bring the Normal Select (pointer) indicator on said desired menu and select it by using a predefined key such as one of the keys 1313 of the telephone-type keypad 1303 or one of the additional keys 1308 on said device, etc.

As for a computer, then the user may press said key to open the related menu bar 1312. To select a function 1313 of said menu bar1312, the user may maintain said key pressed and after bringing the Normal Select (pointer) indicator 1306 on said function, by releasing said key, said function may be selected.

Other functionalities similar to those of a computer may be provided by using said keypad and said mouse.

Also, instead of using said keys assigned to a mouse, a user may use a predefined voice/speech or other predefined behavior(s) to replace the functions of said keys. For example, after positioning the Normal Select (pointer) indicator 1306 on an icon, instead of pressing a key, the user may say "select" or "open" to select or open the application represented by said icon.

Fig. 14, shows an electronic device such as a mobile phone 1400. A plurality of different icons 1411-1414 representing different applications, are displayed on the screen 1402 of said device. To select and/or open one of the

applications, as for computers, by using a mouse, a user may bring the a Normal Select (pointer) indicator 1403, on a desired icon 1411. Then said user may select said icon by for example pressing once, a predefined key 1404 of said keypad. To open the application represented by said icon, the user, for example, may double tap on a predefined key 1404 of said keypad.

The mouse integrated in the backside of an electronic device may be of any type. For example, Fig.15 shows the backside of an electronic device 1500 such as the ones shown in figs. 13-14. The mouse 1501, is similar to a conventional computer mouse. It may be manipulated, as described, with a user's finger. It may also be manipulated like a conventional computer mouse, by laying the device on a surface such as a desk and swiping said mouse on said surface.

Fig. 16, shows another conventional type of mouse (a sensitive pad) integrated on the backside of an electronic device 1500 such as the ones shown in figs. 13-14. The mouse 1601, is similar to a conventional computer mouse. It may be manipulated, as described, with a user's finger. in this example, preferably as described before, while holding the device in the palm of his hand, the user uses his index finger 1602 to use (e.g. to manipulate) said mouse. Accordingly to this position, the user uses his thumb (not shown) to manipulate the keys of a keypad (not shown) which is located in the front side (e.g. other side) of said device.

Mobile devices should preferably, be manipulated by only one hand. This is because while the users are in motion (e.g. being in a bus or in a train) the users may use the other hand for other purposes such as holding a bar while standing in a train or using one hand to hold a newspaper or a briefcase).

By implementing the mouse in the back of a device such as a mobile phone, the user may manipulate said device and to enter data with one hand. He can use simultaneously, both, the keypad and the mouse of said device.

Of course, if he desires, said user can use his both hands to manipulate said device and its mouse.

Another method of using said device is to dispose it on a surface such as on a desk and slide said device on said surface in a same manner as a regular computer mouse and enter the data using said keypad.

It is understood that the any type of mouse including the ones described before, may be integrated in any part of a mobile device. For example, a mouse may be located in the front side of said device. Also said mouse may be located on a side of said device and being manipulated simultaneously with the keypad by fingers explained before.

It should be noted that a mouse has been used through out this discussion, however any point and click data entry device such as stylus computer integrated in an electronic device and combined with a telephone-type keypad is within the contemplation of the present invention.

External integrated data entry unit

Also, an external integrated data entry unit comprising a keypad and mouse may be provided and used in electronic devices requiring data entry means such as keyboard (or keypad) and/or mouse. There may be provided an

integrated data entry unit having the keys of a keypad (e.g. a telephone-type keypad) in front of said unit and a mouse being integrated within the back of said unit. Said data entry unit may be connected to a desired device such as a computer, a PDA, a camera, a TV, a fax machine, etc.

Figs. 19 shows a computer 1900 comprising a keyboard 1901, a mouse 1902, a monitor 1903 and other computer accessories (not shown). In some circumstances (e.g. when a user does not desire to sit down on a desk chair in front of a monitor and he prefers, for example, to lie down on his bed while interacting with said computer) instead of a large keyboard and/or corresponding mouse a user may utilize a small external integrated data entry unit. There may be provided an external data entry unit 1904 containing features such as keypad keys 1911 positioned on the front side of said data entry unit, a microphone which may be an extendable microphone 1906, a mouse (not shown) integrated within the back side of said data entry unit (described before). Said data entry unit may be (wirelessly or by wires) connected to said electronic device (e.g. said computer 1900). An integrated data entry system such as the one described before (e.g. using voice recognition systems combined with interaction of keys by a user) may be integrated either within the said electronic device (e.g. said computer 1900) or within said data entry unit 1904. Also a microphone may be integrated within said electronic device (e.g. computer). Said integrated data entry system may use one or both microphones located on said data entry unit or within said electronic device.(e.g. computer).

For a better view of while interacting, specially when interacting from far with an electronic device such as said computer 1900, a display unit 1905 may be integrated within said a entry unit such as said integrated data entry unit 1904 of this invention. When interacting from far with a monitor 1903 of said electronic device 1900, a user may have a general view of the display 1910 of said monitor 1903. A closed area 1908 around the arrow 1909 or another area selected by using the mouse on the display 1910 of said monitor 1903 may simultaneously be shown on said display 1905 of said data entry unit 1904. The size of said area 1908 may be defined by manufacturer or by the user. Preferably the size of said area 1908 may be closed to the size of the display 1905 of said data entry unit 1904. This may permit a closed and/or if desired a real size view of the interacting area 1908 to the user (e.g. by seeing said area on the data entry screen 1905). While having a general view of the display 1910 of the monitor 1903, a user may have a particular closed view of the interacting area 1908 which is simultaneously shown on the display 1905 of said data entry unit 1904. For example a user may use the keypad mouse (not shown, in the back of the keypad) to navigate the arrow 1909 on the computer display 1910. Simultaneously said arrow 1909 and the area 1908 around said arrow 1909 on said computer display 1910 may be shown on the keypad display 1905.

For an interaction such as opening a file, a user may for example, navigate an arrow 1909 on the screen 1910 of said computer an position it on a desired file 1907. Said navigated areas 1908 and said file 1907 may be seen on said data entry screen 1905. By having the display 1905 of said data entry unit 1904 closed

to his eyes, a user can clearly see his interactions on the display 1905 of said data entry unit 1904 while having a general view on a large display 1910 of said electronic device 1900 (e.g. computer).

It is understood that said interaction area 1908 may be defined and vary according to different needs or definitions. For example, said interacting area may be the area around an arrow 1909 wherein said arrow is in the center of said area or said area is the area at the right, left, top, bottom , etc. of said arrow or any area on the screen of said monitor, regardless of the location of said arrow on the display of said monitor).

Fig. 20 shows a data entry unit 2000 such as the one described before being connected to a computer 2001. During a data entry such as a text entry, the area 2002 around the interacting point 2003 (e.g. cursor) is simultaneously shown on the keypad display 2004.

Figs. 21a-21b show an example of different electronic devices which may use the above described data entry unit. Fig. 21a shows a computer 2100 and fig. 21b shows a TV 2101. The data entry unit 2102 of said TV 2101 may also operate as a remote control of said TV 2101. For example, by using the mouse (not shown) situated in the back side of said data entry unit 2102, a user may locate a selecting arrow 2103 on the icon 2104 representing a movie or a channel and opening it by double tapping (double clicking) on a key 2105 of said data entry unit. Of course said data entry unit 2102 of said TV may also be used for data entry such as internet through TVs or sending massages through TVs, cable

TVs, etc. In this case the integrated data entry system of this invention may be integrated within for example, the TV's modem 2106.

Extendable Microphone

An extendable and /or rotatable microphone may be integrated in electronic devices such as cellular phones. Said microphone may be a rigid microphone being extended towards a user's mouth.

With the advancement of the technology, new input systems and devices are coming to the market to permit easy interacting with instruments. Many of those input systems use voice/speech recognition system wherein a user speaks the data or commands to be input. Because it is a natural way to input data, voice recognition system is becoming very popular. Computers, telephones, toys, and many other instruments are equipped with this different kinds of data entry system using voice recognition systems.

Although this is a good method of input, it has an important shortcoming. It is not a discrete method of input. A user, usually, does not want others to hear what he speaks, and in the other hand people do not like other people's loud speaking.

To overcome (or at least reduce) significantly this problem, the user must speak quietly. To not cause misinterpretation of user's voice/speech by a voice recognition system, the microphone must be closed to user's mouth.

It is the subject of this invention to provide instruments using a user's voice as data, with a microphone extending from said instruments towards the user's mouth.

There are many advantages using such a microphone. One advantage of such a microphone is that by extending said microphone towards said user's mouth and speaking closed into it the voice/speech recognition system may better distinguish and recognize said voice/speech. Another advantage is that by positioning said microphone close to user's mouth (e.g. next to the mouth), a user may speak silently (e.g. whisper) into it. This permits an almost silent and a discrete data entry. Still, another advantage of said microphone is that because of being integrated in corresponding electronic device, in order to keep said microphone in a desired position (e.g. close to a user's mouth), a user may not have to hold said microphone by his hand(s). Also, said user does not have to carry said microphone separately from said electronic device.

By combining the features such as the enhanced keypad of the invention, the mouse, the extendable microphone and the data entry method in a manner such as the manners explained before, either in an electronic device or as an external unit to be connected to an electronic device, a completely enhanced data entry system may be provided. A user, may for example, by only using one hand, hold an electronic device such as a data entry device (e.g. mobile phone, PDA, et.), use all of the features such as the enhanced keypad, integrated mouse, and the extendable microphone, etc., and in the same time by using his natural

habitudes (e.g. pressing keys of the keypad and in needed, speaking) provide a quick, easy, and specially natural data entry.

One of the most important applications of the extendable microphone is when the data entry systems of mobile communication devices combine use of keypad and voice/speech recognition system. In this method a user interacts with a key (for example by pushing it), and in the same time he may speak for example, a symbol on said key. In order to press a key containing a desired symbol, the user may need to see the keypad. He also may need to see the data on a display of the device. In the other hand, the user may prefer to speak said symbols quietly. The extendable microphone permits to position the mobile phone far from eyes, enough to see that keypad, and in the same time to have the microphone closed to the mouth, permitting to speak quietly.

As they many people are used to, they may hold their mobile phone in one hand, while pressing the keys of the keypad with a thumb of the same hand. The second hand may be used to either hold said hand around the microphone to reduce the outside noise, or to keep the microphone in an optimal relationship with the mouth.

If the microphone of an instrument is wireless, or the member connecting it with the instrument is made from non-rigid materials, the user may hold the microphone in a manner to position it at the palm side of his hand, between two fingers. Then by positioning the palm o said hand around the mouth he can significantly reduce the outside noise while speaking.

It is understood that the user interface containing the data entry unit and the display, of an electronic device using a user's voice to input data, may be of any kind. For example, instead of a keypad it may contain a touch sensitive pad, or it may be equipped only with a voice recognition system without the need of a keypad.

Fig. 18, shows according to one embodiment of the invention, an electronic device 1800 such as a cellular phone or a PDA. As shown, the keypad 1801 is located in the front side of said device 1800. A mouse (not shown) is located in the backside of said device 1800, An extendable microphone 1802 is also integrated within said device. Said microphone may be extended and positioned in a desired position (e.g. next to the user's mouth) by a user. Said device may also contain a data entry method as described before. By using only one hand, a user may proceed to a quick and easy data entry with a very high accuracy. Positioning said microphone next to user's mouth, permits a better recognition of the voice/speech of the user by the system. Said user, may also speak silently (e.g. whisper) into said microphone. This permits an almost silent data entry.

In alternative embodiments of the present invention Figs.18b to 18c, show a mobile phone 1800 having a keypad 1801 and a display unit. The mobile phone is equipped with a pivoting section 1803 with a microphone 1802 installed at its end. By extending the microphone towards his mouth, the user may speak quietly into the phone and in the same time being capable to see the display and keypad

1801 of his phone and eventually use them simultaneously while speaking to microphone 1802.

Fig.18d, shows a rotating extendable microphone 1810 to permit a user to position the instrument at a convenient relationship to him, and in the same time by rotating and extending the microphone accordingly, to bring microphone 1810 close to his mouth or to a desired location. It must be noted that the member connecting the microphone to the instrument may have at least two sections, being extended/retracted according to each other and to the instrument. They may have folding, sliding, telescopically and other movement for extending or retracting.

Figs. 18e and 18f, shows an integrated rotating microphone 1820 being telescopically extendable. In this embodiment, the extendable section comprising microphone 1820 may be located in the instrument. When desired, a user may pull this section out and extend it towards his mouth. Microphone 1820 may also be used, when it not pulled out.

According to another embodiment of the invention as shown in Figs. 18g and 18h, the extending member 1830 containing a microphone 1831, may be a section of a multi-sectioned device. This section may be used as the cover of said device. The section comprising the microphone 1831 may itself been multi-sectioned to be extendable and/or adjustable as desired.

According to embodiment shown in Fig. 18i, an extendable microphone 1840 as described before, may be installed in a computer or similar devices.

Also, according to another embodiment of the invention, a microphone of an instrument may be attached to a user's ring, or itself being shaped like a ring, and be worn by said user. This microphone may be connected to said instrument, either wirelessly or by wire. When in use, the user approaches his hand to his mouth and speaks.

It is understood that instruments shown in the drawings are shown as example. The extendable microphone may be installed in any instrument. It may also be installed at any location on extending section.

In communication devices, the extending section comprising the microphone may be used as the antenna of said instruments. In this case the antennas may be manufactured as sections described, and contain integrated microphones.

It must be noted that in addition to at least an extendable microphone, an instrument may comprise at least one additional regular microphone, wherein said microphones may be used separately or simultaneously with said extendable microphone.

It must be noted that the extendable member comprising the microphone may be manufactured with rigid materials to permit positioning the microphone in a desired position without the need of keeping it by hand.

For better manipulation, the section comprising the microphone may also be manufactured by semi rigid or soft materials.

It must be noted that any extending/retracting methods such as unfolding/folding methods may be used.

As described before, the integrated keypad and/or the mouse and/or the extendable microphone of this invention may also be integrated within a variety of electronic devices such as a PDA, a remote control of a TV, and a large variety of other electronic devices. For example, by using said integrated keypad and mouse within remote control of a TV, a user may point on an icon, shown on the TV screen relating to a movie and select said movie by using a predefined key of said remote control.

Also, as described, said integrated keypad and/or mouse and/or extendable microphone may be manufactured as a separated device and to be connected to said electronic devices.

Of course said keypad, alone or integrated with said mouse and/ or said extendable microphone, may be combined with a data and text entry method such as the data entry method of this invention.

Fig. 17 shows some of the electronic devices which may use the enhanced keypad, the enhanced mouse, the extendable microphone, and the data entry method of this invention.

An electronic device may contain at least one or more of the features of this invention. It may, for example, contain all of the features of the invention as described.

Data entry through a land line phone

The data entry method described before, may also be used in land-lined phones and their corresponding networks. As known, each key of a telephone keypad generates a predefined tone which is transmitted through the land line networks. There are twelve predefined tones assigned to twelve keys of telephone keypads. By using, a land line telephone and its keypad, for the purpose of a data entry such as entering text, there may be the need of additional tones to be generated. To each symbol, there may be assigned a different tone so that the network will recognize a symbol according to the generated tone assigned to said symbol.

A wrist-worn multi-sectioned data entry unit

Fig. 22a shows as example, different embodiments of a data entry units 2201-2203 of this invention as described before. To reduce the size of said data entry unit a multi-sectioned data entry unit 2202-2203 which may have a multi-sectioned keypad 2212-2222 as described before, may be provided. said multi-sectioned data entry unit may have some or all of the features of this inventions. It may also have an integrated data entry system described in this application. As example, the data entry unit 2202 comprises a display 2213 an antenna 2214 (may be extendable), a microphone 2215 (may be extendable), a mouse integrated in the beck of said data entry unit (not shown).

An embodiment of a data entry unit of this invention may be carried on a wrist. It may be integrated within a wrist worn device such as a watch or within a

bracelet such as a wristwatch band. Said data entry unit may have some or all of the features of the integrated data entry unit of this invention. This will permit to have a small data entry unit attached to a user's wrist. Said wrist-worn data entry unit may be used as a data entry unit of any electronic device. By connecting his wrist-worn data entry unit to a desired electronic device, a user for example, may open his apartment door, interact with a TV, interact with a computer, dial a telephone number, etc.. A same data entry unit may be used for operating different electronic devices. For this purpose, an access code may be assigned to each electronic device. By entering (for example, through said data entry unit) the access code of a desired electronic device a connection between said data entry unit and said electronic device may be established.

Fig. 22b shows an example of a wrist-worn data entry unit 2290 (e.g. multi-sectioned data entry unit having a multi-sectioned keypad 2291) of this invention (in open position) connected (wirelessly or through wires 2292) to a hand-held device such as a PDA 2293. Said multi-sectioned data entry unit 2290 may also comprise additional features such as some or all of the features described in this application. In this example, there are provided a display unit 2294 an antenna 2295, a microphone 2296 and a mouse 2297.

It is understood that said multi-sectioned keypad may be detached from the wrist worn device/bracelet 2298. For this purpose different detachment/attachment known to people skill in the art may be provided. For example, as shown in fig. 23a, a housing 2301 for containing said data entry device may be provided within a bracelet 2202. Fig. 23b shows said housing

2303 in open position. A detachable data entry unit 2304 may be provided within said housing 2301. Fig 23c shows said housing in open position 2305 and in close position 2306. In open position (e.g. when using said data entry unit), part of the elements 2311 (e.g. part of the keys and/or display, etc) of said data entry unit may lye down within the cover 2312 of said housing.

According to one embodiment of the invention, a device such as a wristwatch 2307 may be provided in the opposite side on the wrist within the same bracelet. For example, there may be provided a wristwatch band having a housing to contain a data entry unit. Said wristwatch band may be attached to any wrist device such as a wristwatch, a wrist camera, etc. The housing of the data entry device may be located on one side 2308 of a wearer's wrist and the housing of said other wrist device may be located on the opposite side 2309 of said wearer's wrist. To attach said wristband to a device such as a wristwatch the traditional wristwatch band attachment means 2310 (e.g. bars) may be provided.

The above mentioned wristband housing may also be used to contain any other wrist device. for example, instead of containing a data entry unit, said wrist housing may be adapted to contain a variety of electronic devices such as a wristphone.

There may be a lot of advantages when using a wrist-worn data entry unit of this invention. for example, a user may carry an electronic device in for example, his pocket, and having a display unit (may be flexible) of said electronic device in his hand. The interaction with said electronic device may be provided through said wrist-worn data entry unit. In another example, the wrist-worn data

entry unit of this invention may be used to operate an electronic news display (a PCT application regarding an electronic news display has been filed on October 27th, 2000 by the inventor).

Extendable Display Unit

According to one embodiment of the invention an extendable display unit may be provided within an electronic device such as data entry unit of the invention or within a mobile phone. Fig. 24a shows an extendable display unit 2400 in closed position. This display unit may be made of rigid and/or semi rigid materials and may be folded or unfolded for example by corresponding hinges 2401, or being telescopically extended or retracted, or having means to permit it being expanded and being retracted by any method.

Fig 24b shows a mobile computing device 2402 such as a mobile phone having said extendable display 2400 of this invention, in open position, When open, said extended display unit may have the width of an A4 standard paper permitting the user to see and work on a real width size of a document while, for example, said user in writing a letter with a word processing program or browsing a web page.

The display unit of the invention may also be made from flexible materials. Fig 25a shows a flexible display unit 2500 in closed position.

It is understood that the display unit of the invention may also display the information on at least part of it's other (e.g. exterior} side 2505. This is

important because in some situations a user may desire to use the display unit without expanding it.

Fig. 25b shows an electronic device 2501 having a flexible display unit 2500 of the invention, in open position.

By having an electronic device such as the data entry unit of the invention, a mobile phone, a PDA, etc., having at least one of the enhanced features of the invention such as an extendable/non extendable display unit comprising a telecommunication means as described before, a mouse of the invention, an extendable microphone, an extendable camera, a data entry system of the invention, a voice recognition system, or any other feature described in this application, a complete data entry/computing device, which may be held and manipulated by one user's hand, may be provided. This is very important because as is well known that in mobile environment computing/data entry at least one of the user's hand must be free.

Extendable Camera

As described for extendable microphone, an electronic device may also be equipped with an extendable camera. For example, for the data entry system of the invention combining keys presses and lip reading (instead or in addition to voice/speech of the user) an extendable camera may be provided in corresponding electronic device or data entry unit..

Fig.26 shows a mobile computing device 2600 equipped with a pivoting section 2601. Said pivoting section may have a camera 2602 and/or a microphone 2603 installed at, for example, its end. By extending the camera towards his mouth, the user may speak to the camera and the camera may transmit images of the user's lips for example, during data entry of the invention using combination of key presses and lips. The user, in the same time may be capable to see the display and the keypad of his phone and eventually use them simultaneously while speaking to the camera. Of course the microphone installed on the extendable section may transmit the user's voice to the voice recognition system of the data entry system.

The extendable section 2601 may contain an antenna, or itself being the antenna of the electronic device.

Also, the extendable microphone and/or camera of the invention may be detachably attached to an electronic device such as a mobile telephone or a PDA. This is because in many situations manufacturers of electronic devices (such as mobile phones) do not desire to modify their hardware for new applications.

According to one embodiment of the invention, the external pivoting section comprising the microphone and/or a camera may be a separate unit being detachably attached to the corresponding electronic device. Fig. 27 shows a detachable unit 2701 and an electronic instrument 2700, such as a mobile phone, being in detached position. The detachable unit 2701 may comprise any one of a number of component, including but not limited to, a microphone 2702, a camera 2703, a speaker 2704, an optical reader (not shown) or other components

necessary to be closed to the user for better interaction with the electronic instrument. The unit may also comprise at least one antenna or itself being an antenna. The unit may also comprise attachment and/or connecting means 2705, to attach unit 2701 to electronic device 2700 and to connect the components available on the unit 2701 to electronic instrument 2700. For attaching and connecting purposes, attachment and connecting means 2705 may be adapted to use the ports 2706 available within an electronic device such as a mobile phone 2700 or a computer, the ports being provided for connection of peripheral components such as a microphone, a speaker, a camera, an antenna, etc. It is understood that ports 2706 may be the standard ports such as a microphone jack or USB port, or any other similar connection means available in electronic instruments. In this case, the attachment/connecting means may, for example, be standard connecting means which plug into corresponding port(s) available within the electronic instrument.

It is understood that the attachment and/or connecting means of the external unit may be provided to have either mechanical attaching functionality or electrical/electronic connecting functionality or both. As shown in Fig. 27a, for example, the external unit 2701 may comprise a pin 2705 fixedly positioned on the external unit for mechanically attaching the external unit to the electronic instrument. The pin may also electrically/electronically connect for example, the microphone component 2702 available within the unit 2701 to the electronic instrument shown before. In addition to the pin, the external unit may contain another connector 2707 such as a USB connector, connected by wire 2708 to for

example, a camera 2703 installed within the external unit 2701. In this case, the connector 2707 may only electronically/electrically connect the unit 2701 to the electronic instrument.

For better mechanical attachment more that one port may be used by attachment and connecting means of the external unit. For example, the attachment and connecting means may comprise two attachment means, such as two pins fixedly positioned on the external unit wherein a first pin plugs into a first port of the electronic instrument corresponding to for example an external microphone, and a second pin plugs into the port corresponding to for example an external speaker.

Fig. 27b shows the detachable external unit 2701 and the electronic instrument 2700 of the invention, in attached position.

After attaching the external unit 2701 to the electronic instrument 2700 (for example, by plugging the pin 2705 into corresponding port 2706) the user may adjust the external unit 2701 in a desired position by extending and rotating movements as described before in this application for extendable microphone and camera. Again, it must be noted that the detachable unit of the invention may have characteristics similar to those of the extendable section of the invention as described before for the external microphone and camera in this application. For example, the detachable unit 2701 of the invention may be multi-sectioned having at least two sections 2710-2711, wherein each section having movements such as pivoting, rotating and extending (telescopically, foldable/unfoldable),

relating to each other and to the external unit. Attaching sections 2712-2714 may be used for these purposes.

The detachable unit as described permits to add external/perpheral components to an electronic instrument and use them as they were part of the original instrument. This firstly permits to use the unit without holding the components in hand or attaching it to user's body (e.g. a headphone which must be attached to user's head) and secondly, it permits to add the components to the electronic instrument without obliging the manufacturers of the electronic instruments (such as mobile phones) to modify their hardware.

The data entry method of this invention may also use other data entry means. For example, instead of assigning the symbols to the keys of a keypad, said symbols may be assigned to other objects such as the fingers (or portions of the fingers) of a user. Also instead of (or in addition to) voice/speech input, the system may recognize the data input by reading (recognizing the movements of) the lips of the user in combination with/without key presses. The user may press a key of the keypad and speak a desired letter among the symbols on said key. By recognizing the movements of the user's lips speaking said letter combined with said key press, the system may easily recognize and input the intended letter.

Also as mentioned, example given in method of configuration described in this application were showed as samples. Variety of different configurations and assignment of symbols may be considered depending on data entry unit needed. The principle in this the method of configuration is to define different group of symbols according to different factors such as frequency of use, natural

pronunciation, natural non-pronunciation, etc, and assign them accordingly assigning them priority rates. The highest priority rated group (with or without speaking) is assigned to easiest and most natural key interaction (e.g. a single press). This group also includes the highest ranked non-spoken symbols. Then the second highest priority is assigned to second less easier interaction (e.g. double press) and so on.

With continuous reference to data entry system described before, the assignment of symbols to the keys of a keypad may be made in manner to still more enhance the recognition by voice/speech or lip-reading systems. Fig. 28 shows a keypad 2800 wherein letter symbols having closed pronunciation are assigned to the keys of said keypad in a manner to avoid ambiguity between them. As shown, letters having closed pronunciations "c" & "d", "j" & "k", "m" & "n", "v" & "t", are separated and placed on different keys. This will help the speech recognition system to more easily recognize said letters. For example, to select the letter "c", a user may press the key 2801 and says "c". To select the letter "d", the user presses the key 2802 and says "d". Other letters having closed pronunciations such as "b" & "p", "t" & "d", "f" & "s", are also assigned to different keys.

Embedded speech recognition systems for small devices are designed to use memory as less as possible. Separating symbols having resembling pronunciation and assigning them to different keys, dramatically simplifies the recognition algorithms resulting the use of less memory.

With continuous reference to Fig. 28, as shown, the configuration of letters is provided in a manner to maintain the letters a-z in continuous order (e.g. a,b,c.....z). Configuration of symbols on the keypad 2800 is made in a manner to keep it as similar as possible to a standard telephone-type keypad. It is understood that this order may be changed if desired.

Also, separation of resembling lip-articulated symbols may help lip-reading (lip recognition) systems to more easily recognize them. For example, assigning letters "j" & "k" to different keys will dramatically ease their recognition.

It is understood that for recognizing a spoken symbol such as a letter, more than one image of user's lips at different times during speaking said letter may be provided to lip recognition/reading system.

Lip reading (recognition) system of the invention may use any image-producing and image-recognition processing technology for recognition purposes. For example, as mentioned before, a camera may be used to receive image(s) of user's lips while said user is saying a symbol such as a letter and is pressing the key corresponding to said symbol on the keypad. Other image producing and/or image capturing technologies may also be used. For example, instead of a camera, a projector and receiver of means such as light or waves may be used to project said means to the user's lips (and eventually, face) and receives back said means providing a digital image of user's lips (and eventually user's face) while said user is saying a symbol such as a letter and pressing the key corresponding to said symbol on the keypad.

The data entry system of the invention which combines key press and user behavior (e.g. speech) may use different behavior (e.g. speech) recognition technologies. For example, in addition to movements of the lips, the pressing action of the user's tongue on user's teeth may be detected for better recognition of the speech.

According to one embodiment of the invention, as shown in fig. 29, instead of (or in addition to) a camera, the lip reading system of the invention may use a touch/press sensitive component 9900 removabley mounted on user's denture and/or lips. Said component may have sensors 9903 distributed within its surface to detect a pressure action on any part of it permitting to measure the size, location, pressure measure, etc., of the impact between the user's tongue and said component. Said component may have two sections. A first section 9901 being placed between the two lips (upper and lower lips) of said user and a second 9902 section being located on the user's denture (preferably the upper front denture). An attaching means 9904 permits to attach/fix said component on user's denture.

Fig. 29a shows a sensitive component 9910 as described hereabove, being mounted on a user's denture 9919 in a manner a section 9911 of the component is located between the upper and lower lips of said user (in this figure, the component, the user's teeth and tongue are shown outside user's body). Said user may press the key 0013 which contains the letters "abc", and speak the letter "b". By saying "b" the lips 9914-9915 of the user press said sensitive section 9911 between the lips. The system recognizes that the intended letter is the letter "b" because saying the two other letters (e.g. "ab") do not require pressing the lips on

each other. If the user presses the key 9913 and pronounces the letter "c", then the tongue 9916 of the user will slightly press the inside portion 9912 of the denture section of the component located on the front user's upper denture. The system will recognize that the intended symbol is the letter "c", because other letters on said key (e.g. "bc") do not require said pressing action on said portion of the component. If the user presses the key 9913 and says the letter "a", then no pressing action will be applied on said component. Then the system recognizes that the intended letter is the letter "a". In other example, if the user presses the key 9917 and says the letter "j" the tongue of the user presses the inside upper portion of the denture section of the component. If the user presses the key 9917 and says the letter "l", then the tongue of the user will press almost the whole inside portion of the denture section of the component. In this case, almost the whole sensors distributed within the inside portion of the denture section of the component will be pressed and the system recognizes that the intended letter is the letter "l".

The above-mentioned lip reading/recognition system permits a discrete and efficient method of data input with high accuracy. This data entry system may particularly be used in sectors such as the army, police, or intelligence.

Hereafter an example of a letter input recognition system through a telephone-type keypad, according to one embodiment of this invention:

ABC key

A	B	C
no pressure	*lip section pressed*	*upper inside portion of the denture section is slightly pressed*

DEF key

D	E	F
whole inside denture section is pressed	*no pressure*	*lip section pressed*

GHI key

G	H	I
upper inside portion of the denture section is strongly pressed	*upper inside of portion of the denture section is slightly pressed*	*no pressure*

JKL key

J	K	L
upper inside portion of the denture section is slightly pressed	*no pressure*	*whole inside denture section is pressed*

MNOkey

M	N	O
lip section pressed	*whole inside denture section pressed*	*no pressure*

PQRSkey

P	Q	R	S
lip section pressed	*lip section pressed (on sides)*	*no pressure*	*upper inside portion of the denture section is slightly pressed*

TUVkey

T	U	V
whole inside denture section is pressed	*lip section pressed (on sides)*	*lip section pressed*

WXYZkey

W	X	Y	Z (zed)
lip section pressed	*upper inside portion of denture section is pressed*	*no pressure*	*whole inside portion of the denture is pressed*

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It must be noted that the table above is only shown as an example to show the easiness of distinguishing the letters by saying a desired letter (while using the described hardware) and pressing the corresponding key. It is understood that other distinguishing parameters such as the timing of the pressure on the hardware (e.g. when saying "g" or saying "h", both being on the same key and maybe having similar pressure levels) based on this system may be taken in consideration by the recognition system and people skilled in the art. Also, saying other symbols such as numbers (e.g. 0-9) by the user and recognizing them may be considered by the above-mentioned system.

In addition, the sensitive component of the invention may be connected to processing device (e.g. a cellphone) wirelessly or by means wires. If it is connected wirelessly, the component may contain a transmitter for transmitting the pressure information. The component may further comprise a battery power source for powering its functions,

As described before, the invention combines key presses and speech for improved recognition accuracy. In one embodiment, a grammar is made on the fly to allow recognition of letters corresponding only to the key presses.

As is well know in the art (e.g., LetterWise), letter-pair frequency probabilities can be used to determine the next letter given the previous letter.

The above grammars created to support the combination of key presses and speech can be augmented with probability information to provide for higher accuracy.

For example, if a user presses 8-4-3 and says T-H-E, then the system should recognize T-H-E. However, since the 3 key includes the letters D-E-F, it could also incorrectly recognize T-H-D. To avoid this problem, we can add probabilities.

For the key 8, we have the letters T-U-V; for 4 we have G-H-I; and for 3 we have D-E-F. Given the key presses 8-4-3, the system would create the following grammar using standard grammar notation:

<s> = (T | U | V) (G | H | I) (D | E | F);

This can also be expressed as

<s> = T <s1>;

<s> = U <s1>;

<s> = V <s1>;

<s1> = G <s2>;

<s1> = H <s2>;

<s1> = I <s2>;

<s2> = D;

<s2> = E;

<s2> = F;

Adding simple unigram probabilities for the first set of letters and bi-gram probabilities (for example, trained on a word corpus such as dictionary) we might have something such as:

<s>, 0.80 = T <s1_T>;

<s>, 0.15 = U <s1_U>;

<s>, 0.05 = V <s1_V>;

<s1_T>, 0.05 = G <s2_G>;

<s1_T>, 0.65 = H <s2_H>; // 0.65 represents the probability of H preceded by T in the current context

<s1_T>, 0.30 = I <s2_I>;

<s1_U>, 0.30= G <s2_G>;

<s1_U>, 0.50= H <s2_H>;

<s1_U>, 0.20 = I <s2_I>;

<s1_V>, 0.01 = G <s2_G>;

<s1_V>, 0.04 = H <s2_H>;

<s1_V>, 0.95 = I <s2_I>;

<s2_G>, 0.05 = D;

<s2_G>, 0.85 = E;

<s2_G>, 0.10 = F;

<s2_H>, 0.10 = D;

<s2_H>, 0.85 = E;

<s2_H>, 0.05 = F;

<s2_I>, 0.20 = D;

<s2_I>, 0.20 = E;

<s2_I>, 0.60 = F;

Note that the grammars are larger, but since they are built on the fly they are still manageable for embedded applications.

Note that the probabilities can be based strickly on letter-pair frequencies, but also weighted by the relative word frequency from which they come. For example, the letter pair T-H might count for more from the word THE vs the word THIN.

Note that the recognizer will pursue all paths in parallel and combine the acoustic probabilities with the grammar probabilities to compute the overall best answer.

Usually, during data (e.g. text) entry by voice/speech, a microphone/transducer perceives the user's voice/speech and transmits it to a processor of a desired electronic device for recognition process by a voice/speech recognition system. A great obstacle (specially, in the mobile environment) for an efficient speech to data/text conversion by the voice/speech recognition systems is the poor quality of the inputted audio, said poor quality being caused by the outside noise. It must be noted that the microphone "hears" everything without distinction.

Many efforts have been made by researchers to distinguish and eliminate an outside noise from a desired audio. Until now those efforts have permitted to only partially reduce the outside noise but still much more work must be done to

achieve an acceptable result. Unfortunately, the current noise cancellation/reduction technologies also reduce the quality of the desired audio, making said audio inappropriate for recognition by the voice/speech recognition systems.

To reduce (or even completely eliminate) the outside noise during data entry into an electronic device by voice/speech input, without degrading the quality of said voice/speech input an ear-integrated microphone/transducer unit positioned in a user's car can be provided. Said microphone/transducer may also permit a better reception quality of the user's voice/speech, even if said user speaks low or whispers.

As is well known, when humans speak, the bone vibrations caused by, and corresponding to, said speech are conducted to ear resulting the air vibrations corresponding to said speech in th inner ear and in the ear canal.

According, to one method, said air vibrations may be perceived by an ear-integrated microphone positioned in the ear, preferably in the ear canal.

According to another method, said ear bone vibrations, themselves, may be perceived from the inner ear by an ear-integrated transducer positioned in the ear.

Fig. 30 shows a microphone/transducer unit 5300 designed in a manner to be integrated within a user's ear in a manner that the microphone/transducer component 5301 locates inside the user's ear (preferably, the use's ear canal).

Preferably, in addition to microphone/transducer component 5301, said unit 5300 may also have hermetically isolating means 5302 wherein when said

microphone 5301 is installed in a user's ear (preferably, in the user's ear canal), said hermetically isolating means 5302 may isolate said microphone from the outside (ear) environment noise, permitting said microphone 5301 to only perceive the user's voice/speech formed inside the ear. The outside noise which is a major problem for voice/speech recognition systems will dramatically be reduced or will even be completely eliminated.

The user may adjust the level of hermitically isolation as needed. For example, to cancel the speech echo in the ear canal said microphone may be less isolated from outside ear environment by slightly extracting said microphone unit from said user's ear canal. The microphone unit may also have integrated isolating/unisolating level means.

Said microphone/transducer 5301 may be connected to a corresponding electronic device, by means of wires 5303, or by means of wireless communication systems. The wireless communication system may be of any kind such as blue-tooth, infra-red, RF, etc.

The above-mentioned, ear integrated microphone/transducer may be used to perceive the voice/speech of a user during a voice/speech-to-data (e.g. text) entry system using the data entry system of the invention combining key press and corresponding speech, now named press-and-speak (KIKS) technology. By pressing a key and saying the desired symbol (e.g. a letter) assigned to said key, as described before, the voice/speech recognition system tries to match said speech to one of speech patterns of only few symbols assigned to said key. In this case, even if an ear-integrated microphone/transducer has lower equality audio

perception than a standard microphone, the quality of spoken symbols perceived by said ear-integrated microphone/transducer will still be fair enough to permit the voice/speech recognition system to easily recognize a spoken symbol among said few symbols on that key.

According, to one embodiment of the invention, as shown in fig. 31, an ear-integrated microphone 5400 may be provided and be connected to a mobile electronic device such as a mobile phone 5402. As shown, the microphone 5401 is designed in a manner to be positioned into a user's ear canal and perceive the user's speech/voice vibrations produced in the user's ear when said user speaks. Said speech may then be transmitted to said mobile phone 5402, by means of wires 5403, or wirelessly.

By being installed in the user's ear and having hermetically isolating means 5404, said microphone 5401 will only perceive the user's voice/speech. The outside noise which is a major problem for voice/speech recognition systems will dramatically be reduced or even completely be eliminated. As mentioned before, the level of isolation may be adjustable, automatically, or by the user.

For example, when a user presses a key 5405 and speaks the letter "k" which is located on said key, the vibrations of said speech in the user's ear may be perceived by said ear-integrated transducer/microphone and be transmitted to a desired electronic device. The voice/speech recognition system of the invention has to match said speech to already stored speech patterns of a few symbols located on said key (e.g. in this example, "J, K, L, 5"). Even if the quality of said

speech is not good enough (e.g. because the user spoke low), said speech could be easily matched with the stored pattern of the desired letter.

As just noted, another advantage of this system is that the user may speak low or even whisper. Because on one hand, the microphone is installed in the user's ear and directly perceives the user's voice without being disturbed by outside noise, and on the other hand the recognition system tries to match a spoken symbol to only few choices, even if a user speaks low, whispers, the quality of the user's voice will still be good enough for use by the voice/speech recognition system. For the same reasons the recognition system may be user-independent. Of course, training the system with the user's voice (e.g. speaker dependent method) will cause greatly better recognition accuracy rate by the recognition system.

In addition to the microphone/transducer, the ear-integrated unit may also contain a speaker located beside the microphone/transducer and also being integrated within the user's ear for listening purposes.

According to one embodiment of the invention, as shown in fig. 32, an ear-integrated microphone and speaker 5500 can be provided in a manner that the microphone 5501 installs in a first user's ear (as described here-above) and the speaker 5502 installs in a second user's ear.

The above specifications should not be construed as limiting the scope of the invention but merely describing some of the preferred embodiments of the invention. Many variations are to be considered within the scope of the present invention. For example, in the example of the ear-integrated unit of the fig. 32,

both ears may be provided by both, microphone and speaker components. In another example, when said ear-integrated unit is wirelessly connected to a corresponding electronic device, a battery power source may be provided within said ear-integrated unit. Also for better speech reception quality, the ear-integrated microphone unit of the invention may also comprise at least an additional standard microphone situated outside of the ear (for example, on the transmitting wire). The inside ear microphone combined with the outside ear microphone may provide more audio signal information to the speech/voice recognition system of the invention. It must also be noted that the data entry system of the invention may use any microphone or transducer using any technology to perceive the inside ear speech vibrations.

Background

A method of general data entry combining key press and speech has been explained in PCT application PCT/US00/29647.

As described in said application, by pressing a key and speaking/not speaking a desired symbol such as a character among a group of symbols assigned to said key, said desired symbol may be selected. For example, for entering the word "morning" through a standard telephone-type keypad (see Fig 81) a user may:

-press the key 8101 and say 'm' ;
-press the key 8101 and say 'o' ;
-press the key 8106 and say 'r' ;
-press the key 8108 and say 'n' ;
-press the key 8104 and say 'i' ;
-press the key 8106 and say 'n' ;
-press the key 8104 and say 'g'.

By speaking a word, letter by letter (or symbol by symbol), and pressing the corresponding keys, said word may be inputted.

The data entry system described in said PCT may permit a keyboard having reduced number of keys (e.g. telephone keypad) to act as a full-sized PC keyboard (e.g. one pressing action per symbol).

ξ Word by Word Data Entry System

To enhance the above-mentioned data entry system, a word level data entry system has been proposed in said PCT application. In said application, there was described that a user can enter a word by speaking said word and pressing the keys corresponding to the letters constituting said word.

The speech of each word in a language may be constituted of a set of phoneme(s) wherein said set of phoneme(s) comprises one or more phonemes. Fig. 82 shows as an example, a dictionary of words 8200 wherein for each entry (e.g. word) 8201, its character set 8202, relating key press values 8203 (using a telephone keypad), phoneme set 8204 corresponding to said word, and speech model 8205 (to eventually be used by a voice/speech recognition system) of said phoneme set are shown.

According to one method of speech recognition, when a user speaks a word, his speech may be compared with said memorized speech models, and one or more best matched models will be selected by the system. Then the word(s) (e.g. character sets) corresponding to said selected model(s) may be selected by the system. If the selection contains one word, said word may become the final selection. If the selection comprises more than one word, then said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key.

The above-mentioned method of recognition of words based on their speech, is described only as an example. It is understood that other methods of recognition by speech may be considered by the people skilled in the art.

Recognizing a word based on its speech only, is not an accurate system. There are many reasons for this. For example, many words may have similar or confusing pronunciations. Also factors such as the outside noise may result ambiguity in a word level data entry system. Inputting arbitrary words by voice requires complicated software, taking into account a large variety of parameters such as accents, voice inflections, user intention, or noise interaction. For these reasons speech recognition systems are based on recognition of phrases wherein for example, words having similar pronunciations may be disambiguated in a phrase according to the context of said phrase. Speech recognition systems based on recognition of phrases require large amount of memory and CPU use, making their integration in small devices such as mobile phones, impossible at this time.

The press and speak technology invented by this inventor and described in different PCT and US provisional applications filed earlier, may solve the above-mentioned problems. In addition to/combination with a character by character entry system as described in said applications, a word-level data entry technology of the invention may provide the users of small/mobile/fixed devices with a natural quick (word by word) text/data entry system.

As mentioned, in the PCT application PCT/US00/29647, there was described that a user can speak a word while pressing the keys corresponding to the letters constituting said word. There was also mentioned that for this purpose a word dictionary data base may be used. According to that and by referring to the fig. 81, when a user speaks the word "card" and presses the corresponding keys (e.g. keys 8102, 8102, 8106, 8109 of the telephone-type keypad), the system selects from said word dictionary (such as the one shown in fig. 82), the words corresponding to said key presses. In this example, the same set of key presses may also correspond to other words such as "care", "bare", "base", "cape", and "case". The system then, may compare the user's speech (of the word) with the speech of said words having the same key presses and if one of them matches said user's speech, the system selects said word. If speech of non of said words matches the user's speech, the system then, may select the word (or words) that its (their) speech best match(es) said user's speech.

According to this method, the recognition system will select a word among only few candidates (e.g. 6 words, in the example above). As result the recognition becomes easy and the accuracy of the speech recognition system dramatically augments, permitting a general word-level text entry with high accuracy. It must also be noted that speaking a word while typing it is a human familiar behavior.

According to another embodiment of the invention, for entering a word, a user may press few (e.g. one, two, and if needed, more) keys corresponding to the letter(s) of the beginning of a word and (preferably, simultaneously) speak said word. According to said few key presses and said speech, the system may recognize the intended word. For this

purpose, according to one method, for example, the system may first select the words of the dictionary data base wherein to the beginning characters of said words correspond to said key presses, and compares the speech of said selected words with the user's speech. The system, then selects one or more words wherein their speech best matches said user's speech. Selecting the words existing in a dictionary of words database according to the first few key presses, dramatically reduces the number of said selected words to be compared with the user's speech. This permits a very high accuracy of the input of an intended word. According to another method, for example, the system may first select the words of the dictionary wherein their speech best match said user's speech. The system then, may evaluate the beginning characters (evaluating to which key presses the belong) of (the character sets constituting) said words with said user's corresponding few key presses to finally select the character set(s) which their beginning characters match said user's key presses.

In the above-mentioned embodiments, if the selection contains one word, said word may become the final selection. If the selection comprises more than one word, then said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key.

The above-mentioned methods of speaking a word and pressing the keys corresponding to the characters constituting at least part of said word, and comparing said key presses with the key presses corresponding to the letters of the words in a dictionary of words, requires the use of a substantial amount of memory. Having stored the phoneme sets/ speech (e.g. models) of all of the words available in a language, a database of the chain of characters corresponding to said words available in one or more languages, and also having a data base of the key presses corresponding to said words available in said dictionary data base require large amount of memory.

Also, as described in the prior applications, in the character by character data entry system of the invention a symbol such as a punctuation mark may be assigned to a key of the keypad and be inputted as default by pressing said key without speaking speech. For said reason, in the word level data entry system of the invention as described before, a user may finish to speak a word before finishing to enter all of its corresponding key presses. This may confuse the recognition system because those last key presses which were not covered by user's speech may be considered as said default characters. There are some solutions to overcome this problem. For example, a user may first speak a word and then press the corresponding keys. This may indicate to the system that the set of key presses accruing after the speech correspond to said speech.

In another example, the system may exit the text mode and enter into another mode such as a punctuation/function mode, by a predefined action such as, for example, pressing a mode key. As explained in said PCT applications, to each key of a keypad one or two special characters such as punctuation marks, space character, or a functions, may be assigned. By a single press on a key of said keypad without speaking, a symbol such as punctuation mark on said key will be inputted. A double press on the same key without speech may provide another (e.g. punctuation) symbol assigned to said key. By pressing a

key while the system is in said special character mode, a symbol such as a punctuation mark may be entered at the end (or any other position) of the word, also indicating to the system the end of said word.

ξ **Data Entry System Based on sub-speeches**

There must be considered that when a user speaks a word while typing it, he naturally, may break said speech of said word into one or more sub-speech portions (e.g. while he types the letters corresponding to each sub-speech) according to for example, the syllables of said speech. For example, while typing the word "morning" using a keyboard such as a keypad, the user may naturally, first say a first sub-speech, "mor" and/while he presses the corresponding keys. Then the user may pronounce a following sub-speech, "ning" and type the corresponding keys. For easier demonstration, in this application, the word "sub-speech" is used for the speech of a portion of the speech of a word. For example, the word "perhaps", may be spoken in two sub speeches "per" and "haps". Also for example, the word "pet" may be spoken in a single sub-speech, "pet".

Also, for example, for entering the word "playing", the user may first pronounce the phonemes corresponding to the first syllable (e.g. "ple") while typing the keys corresponding to the letters "pla", and then pronounce the phonemes corresponding to the second syllable (e.g. "ying") while typing the set of characters "ying".

It must be noted that one user may divide a word into portions differently from another user. Accordingly, the sub-speech and the corresponding key presses, for each portion may be different. After completing the data (e.g. key press and sub-speech) entry of all portions of said word by said users, the final results will be similar.

In the above-mentioned example, said another user may pronounce the first portion as "plā" and press the keys of corresponding character set, "play". He then, may say "ing' and press the keys corresponding to the chain of characters, "ing". Also for example, a third user may enter the word "playing" in three sequences of sub-speeches and key presses. Said user may say, "ple", "yin", and "g" (e.g. spelling the character "g" or pronouncing the corresponding sound) while typing the corresponding keys. It is understood that the most natural way of dividing a word in different sequences of speech and key presses is that each sequence of speech correspond to a syllable of said word. Therefore, it must be noted that even though in many paragraphs of this application we note a syllable as a portion/sequence of a word, the data entry system of the invention applies to any form of division of a word in one or more portions.

According to the above-mentioned principles, the word "trying' may be pronounced in two portions (e.g. syllables) "trī", and "ing". Also for example, the word "playground" may be divided and inputted in two portions (e.g. according to its two syllables), "plā", and "ground".

As it is shown in the examples above, part of the speech of different words in one (or more) languages may have similar pronunciations (e.g. being composed by a same set of phonemes). For example, the words, "trying", and "playing" have common sub-speech portion "ing" (or "ying") within their speech.

According to the above-mentioned principles, there may be created a method of data entry wherein by memorizing predefined sets of phonemes/speech-models corresponding to sub-speeches of a word and considering at least part of the key presses corresponding to the characters sets assigned to corresponding phoneme sets, recognition of entire words in a press and speak data entry system of the invention may become effective. Fig. 84 shows a dictionary of phoneme sets 8401 corresponding to sub-speeches of whole words dictionary 8402, and a dictionary of character sets 8403 corresponding to the phoneme sets of said phoneme set dictionary 8401, also comprising a dictionary of key press values (according to a telephone keypad) 8404 corresponding to said dictionary of character sets 8403 corresponding to said dictionary of phoneme sets 8401. according to different embodiments of the invention, one or more of these data bases may be used by the data entry system of the invention.

Because in many cases, a same phoneme set (sub-speech model) may be used in order to recognize other words (having the same sub-speech pronunciation in their speech), less memorized phoneme-sets/speech-models are required for recognition of entire words available one or more dictionary of words, reducing the amount of the memory needed. This will result in assignment of reduced number of phoneme sets to the corresponding keys of a keyboard such as a telephone-type keypad and will, dramatically, augment the accuracy of the speech recognition system.

Fig. 83 shows exemplary samples of words of English language 8301 having similar speech portions 8302. As shown, four short phoneme sets 8302, may produce the speech of seven entire words 8301. Is understood that said phoneme sets 8302 may represent part of speech of many other words in English or other languages, too.

Based on the above-mentioned principles, a natural press and speak data entry system using reduced number of phoneme sets for entering any word (e.g. general dictation, arbitrary text entry) through a mobile device having limited size of memory (e.g. mobile phone, PDA) and limited number of keys (e.g. telephone keypad) may be provided. The system may also enhance the data entry by for example, using a PC keyboard for fixed devices such as personal computers. In this case, (because a PC keyboard has more keys), still more reduced number of phoneme sets will be assigned to each key, augmenting the accuracy of the speech recognition system. Hereafter, different detailed embodiments of the invention are described.

All Keys-At Least Part of the Phonemes

According to one embodiment of the invention, a user may divide the speech of a word into different sub-speeches wherein each sub-speech is represented by a phoneme-set. By speaking each phoneme set and/while pressing the keys corresponding to the letters corresponding to said phonemes sets and repeating (in order, from fist to last) this

procedure for all of (or at least part of) said sub-speeches, said entire word (e.g. in characters) may be inputted.

As shown in Fig. 81, for example, the letter "t" is located on the key 8101 of the keypad 8100. To said key different sets of phonemes such as "tē", "ti", "ta", "to", etc., and/or corresponding speech models may be assigned (see table 1, fig. 85). Pronouncing "tē" may correspond to different sets of letters such as "tea", "tee", or even "the" (if the user is for example not an American/English native). To produce the word "teabag" a user may press the "t" key 8101 and say "tē" and continue to press the remaining keys corresponding to the remaining letters, "ea". The system compares the speech of the user with the speech (e.g. models) assigned to the first pressed key (in this example, "t" key 8101). After matching said user's speech to one (or more) of said phoneme-sets/speech-models assigned to said key, the system selects on or more of the character set(s) assigned to said phoneme set(s)/speech-model(s). As mentioned, in this example, a same speech may correspond to two different sets of characters, one corresponding to the letters "tea" (e.g. key presses value 832) and the other corresponding to letters "tee" (e.g. key presses value 833). The system compares (e.g. the value of) the keys pressed by the user with the (e.g. values of) the key presses corresponding to the character sets of said list and if one of them matches the user key presses the system chooses it to eventually being inputted/outputted. In this case the letters "tea" may be the final selection for this stage. An endpoint (e.g. end of the word) signal such as a space key press may inform the system that the key presses and speech for the current entire word are ended.

In the above-mentioned example, the selection is not final. The user then may press the "b" (e.g. corresponding to the first character in the following syllable in the word) key 8102 and say "bag" and continue to press the remaining keys corresponding to the remaining letters "ag". The system proceeds like before and selects the corresponding character set, "bag". The user now, signals the end of the word by for example, pressing an space key.

By saying "tē" and pressing the keys "8, 3, 1" and then saying "bag" and pressing the keys "1, 1, 4", the word "teabag" may be produced. As noticed, the word "teabag" is produced by speech and key presses without having its entire speech model/phoneme-set in the memory. In fact the speech model of the word "teabag" was produced by two other sub-speech models (e.g. of "tē" and "bag") available in the memory, each representing part of said speech model of the entire word "teabag" and together producing said entire speech model. The speech models of "tē" or "bag" may be used as part of the speech-models/phoneme-sets of other words such as "teaming" or "Baghdad", respectively.

Although in this embodiment, the recognition accuracy is very high, it may happen that sometimes the final selection is an erroneous word which do not exist in the data base. For this reason, before inputting/outputting said word, the system may compare the final selection with the words of a dictionary of the word of the desired language. If said selection does not match a word in said dictionary, it is rejected.

Also, according to one method, while pressing the corresponding keys of a portion of a word and speaking it, the user may speak in a manner that his speech covers said

corresponding key presses during said entry. This will have the advantage that the user's speech at every moment corresponds to the key being presses simultaneously, permitting easier recognition of said speech. On the other hand, at the end of the entry of a word, a user may press any key without speaking. This may inform the system that the word is entirely entered (e.g. pressing a key and not speaking may be assigned to characters such as punctuation marks, PC functions, etc. This matter has already been explained in the PCT applications that have already been filed by this inventor).

After completion of the recognition procedures described above, if the selected output comprises more than one word, said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key.

It must be noted that in some cases, recognizing part of the phonemes of one or more sub-speeches of a word (preferably, those at the beginning of said sub speeches), may be enough for recognition of the corresponding word in the press and speak data entry system of the invention.

According to one embodiment of the invention instead of considering all of the phonemes corresponding to a sub-speech of a word, only a few phonemes, (preferably those at the beginning of said sub-speech) may be considered and assigned to the key corresponding to the first letter of the character set(s) corresponding to said phoneme set. Said phoneme set may be used for the recognition purposes by the press and speech data entry system of the invention. Thanks to this method, the number of the speech-models/phoneme-sets necessary for recognition of many entire words may dramatically be reduced. In this case, to each key of a keyboard such as a keypad, only few phoneme sets will be assigned permitting easier recognition of said phoneme sets by the voice/speech recognition system.

By using a speech recognition system for evaluation of all/few (preferably the beginning) characters of each sub-speech (preferably, the first) of a word along with consideration of all of the key presses corresponding to all of the characters of said word, a word in a language may be recognized by the data entry system of the invention.

According to this embodiment, for each letter different sets of phonemes (or speech models) according to sub-speeches of the words in a language may be considered and memorized. Said sets of phonemes may be located at any position within a word. Each of said sets of phonemes may correspond to one or more sets of characters having similar/almost similar pronunciation. Fig. 85 shows an exemplary table showing some of the phoneme sets that may occur at the beginning (or anywhere else) of a syllable of a word starting with the letter "t". In the last row, of the table also shows an additional example of a phoneme set and a relating character set for the letter "i".

Although phoneme sets having more phonemes (e.g. taps, tāke, tāst, etc.) may be considered, modeled, and memorized to help recognition of a word, in this embodiment wherein the user presses all of the keys corresponding to the letters of a word, evaluating/recognizing few beginning characters of one or more portions (e.g. syllables) of

said word by the voice/speech recognition and also using dictionary of words data base and relating databases (such as key presses values) as shown in fig. 84, may be enough for producing said word. obviously, when needed, longer phoneme sets may also be used for better recognition and disambiguity.

As an example, by considering fig. 81 and also using the table 1 of the fig. 85, to produce the word "ti-tle", a user may press the key 8101 corresponding to the letter "t" and say 'tī" and then press the remaining key presses corresponding to remaining letters "itle". At the end of the word the user presses for example, an end-of-the-word key such as a space key. To the phoneme set "tī", character sets such as "ti, ty, tie" are assigned. The first letter "t" is obviously, selected. Second letter will be "i", because of pressing the key 8103 (e.g. "y" is on the key 8104). The next key pressed is the key 8101 relating to the letter "t". in this case the character set "tie" possibility is rejected. So "ti" will be definitively selected. The system now considers "ti" along with the remaining key presses 8 (e.g. "t, u, v"), 5 (e.g. "g, h, i"), and 3 (e.g. "d, e, f"). Comparing these input with a dictionary of words having corresponding key presses data base will reveal that the only word corresponding to these input is the word "title". The system then selects the word "title".

For better recognition, the user may speak more than one sub-speech of a word while pressing the corresponding keys. In this case, the system may consider the input of characters corresponding to more than one sub-speech of said word.

By typing a word (having one or more portions/syllables) through a keyboard/keypad and speaking said word partially/entirely, in almost every case, recognition of few beginning characters of at least one of said syllables (preferably, the first syllable) of said word by the speech recognition system (helped by the evaluation of the corresponding key presses), combined with the evaluation of the key presses corresponding to the rest of the characters of said word will produce said word.

In another example, to enter the word "taken" which comprises two sub-speeches/syllables, "tā" and "ken", when typing the first character "t" (key 8101), the user says "tā" and then presses the rest of the keys (e.g. "a") corresponding to the rest of the characters of the first syllable. The user then naturally proceeds to the next syllable and says "ken" while pressing the key 8105 corresponding to letter "k" and continues to press the remaining keys of said next syllable corresponding to the letters "en". He then may press an space key to inform the system of the end of data entry.

After completion of the recognition procedures described above, if the selected output comprises more than one word, said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key.

Shortcut: Less Key Presses Combined With at least Part of the Phonemes

Small mobile electronic devices having keypads with limited number of keys are commonly used worldwide. Users press the keys of said keypads by using the fingers

(e.g. thumb, forefinger) of one hand. Even in a the above-mentioned data entry systems wherein each symbol is entered by a single pressing action on a corresponding key, the speed of data entry is slower than the speed of the data entry using a PC keyboard wherein the users usually use the fingers of both hands to press the keys of the keyboard.

To enhance the data entry system of the invention and to permit quicker data (e.g. text) entry, a macro-level data/text entry system have been proposed in the PCT application PCT/US00/29647. In said PCT application, there was mentioned that macros (e.g. a chain of letters/characters) can be assigned to a key of a keypad and inputted by a single pressing action combined with/without voice/speech. By assigning at least part of the characters of a word to a single key press an entire word may be inputted by few key presses. By applying this method within the press and speak data entry method of the invention, a quick data entry for mobile environment/small devices may be provided. In this method, the number of key presses are less than the number of the characters of a word (except for the single characters and some words such as out-of-dictionary-words, which may require character by character entry).

According to the preferred embodiment of the invention a user may press the key(s) corresponding to the first letter of portion(s) of a word while, preferably simultaneously, speaking said corresponding portion(s). For this purpose a user may divide a word to different portions according to, for example, the syllables of said speech. Speaking each portion/syllable of a word is called "sub-speech" in this application.

According to this embodiment, for example, to enter the word "tiptop" which may be divided in two sub-speeches (e.g. according to its syllables) "tip" and "top", the user may first press the key 8101 (e.g. letter "t" is assigned to said key) and (preferably, simultaneously) say "tip" (e.g. the first sub-speech of the word "tiptop"), then he may press the key 8101 and (preferably, simultaneously) say "top" (e.g. the second sub-speech of the word "tiptop"). Using the table in the fig. 85, set of characters "tip" is assigned to the set of phonemes "tip" and to the letter "t" on the key 8101. When the user presses the key 8101 and says 'tip", the system compares the speech of the user with all of the phoneme sets/models which are assigned to the key 8101. After selecting one (or more) of said phoneme sets which match said user's speech, the system selects the character sets which are assigned to said selected set(s) of phonemes. In the current example, only one character set (e.g. tip) was assigned to the phoneme set "tip". The system then proceeds in the same manner to the next portion (e.g. sub-speech) of the word, and so on. In this example, the character set "top" was the only character set which was assigned to the phoneme set "top". The system selects said character set. After selecting all character sets corresponding to all of the sub-speeches/syllables of the word, the system then assembles said character sets (e.g. an example of assembly procedure is described in the next paragraph) providing different groups/chains of characters. The system then compares each of said group of characters with the words (e.g. character sets) of a dictionary of words data base available in the memory. For example, after selecting one of the words of the dictionary which best matches to one of said groups of characters, the system may select said word as the final selection. In this example, after entering the second portion/syllable, the user presses for example, a space key, or another key without speaking to inform the system that the word

wad entirely entered (e.g. pressing a key and not speaking may be assigned to characters such as punctuation marks, PC functions, etc). This matter has already been explained in the PCT applications that have already been filed by this inventor.). The system assembles the character sets 'tip' and "top' and produces a group of characters 'tiptop". The system then compares said group of characters with the words available in a dictionary of words data base of the system (e.g. an English dictionary) and if one of said words matches said group of characters the system inputs/outputs said word. In this example, the word "tiptop' exists in an English dictionary of the system. Said word is finally inputted/outputted.

Fig 86 shows a method of assembly of selected character sets of the embodiments. For example, when a user tried to enter the word "envelope" in three sequences by using an embodiment of the invention, the system selected one to two character sets 8601 for each portion. The system then assembles said character sets according to their respective position within said word, providing different group of characters 8602. Said group of characters 8602 will be compared with the words of the dictionary of words of the system and the group(s) of characters which match(es) one or more of said words will be finally selected and inputted. In this example, the character set 8603 (e.g. envelope"), is the only character set which matches a word in said dictionary. Said word is finally selected.

As mentioned, in some cases, the speech recognition system may select more than one phoneme set/speech model for the speech of all/part (e.g. a syllable) of a word. For example, if a user having a "bad" accent tries to enter the word "teabag" according the current embodiment of the invention, he first presses the key 8101 and simultaneously says "tē". The system may not be sure whether the user said "tē", or "thē". In this case the system may select different character sets corresponding to both phoneme sets. By using the same procedure, the user then enters the second portion of the word. In this example, only one character set, "bag", was selected by the system. The user finally, presses an space key. The system, then may assemble (in different arrangements) said character sets to produce different group of characters and compare each of said group of characters with the words of a dictionary of words data base. In this example the possible group of characters may are:

- "teebag"
- "teabag"
- "thebag"

The only group of characters that matches a word in a dictionary of words in for example, English language, is the word "teabag". This word may be considered as the final selection.

As just demonstrated, it may happen that the system selects more than one character set for each/some phoneme sets of a word. In this case, more than one group of characters may be assembled. Therefore, probably, more than one word of the dictionary may match said assembled groups of characters. In this case, said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key. Also, if the system comprises enough memory and processing speed, a

speech recognition system may be used to select one of said selected word according to the corresponding phrase context.

If a word/portion-of-a-word comprises many phonemes but its speech comprises a single syllable, according to one method, a phoneme-set/model comprising all of said phonemes of said word/portion-of-a-word may be assigned to said word. For example, to enter the word "thirst", a phoneme set constituting of all of the phonemes of said world may be assigned to said word and to the letter "t" (e.g. positioned-on/assigned-to the key 8101). The user presses the key 8101 and says "thirst". As explained before, the system selects the character set(s) (in this example, only one, "thirst") of sub-speech(es) (in this example, one sub-speech) of the word, and assembles them (in this example, no assembly). The system then, may compare the said characters set with the words of the dictionary of the word of the system and if said character set matches one of said words in the dictionary, then it selects said word as the final selection. In this case, the word "thirst" will be finally selected.

In some cases, specially when words are comprised of only one syllable, more than one key press for a syllable may be necessary for disambiguation of a word. For this purpose, different user-friendly methods may be implemented. For example, the word "fire", which originally comprises one syllable may be pronounced in two syllables comprising phoneme sets, "fi", and "re", respectively. The user in this case may first press the key corresponding to the letter "f" while saying "fi". He then, may press the key corresponding to the letter "r", and may say "re".

Also, for example, the word "times", may be pronounced in two syllables, "ti" and "mes", or "tim" and "es". Also a word such as "listen", may be pronounced in two syllables, "lis", and "ten" which may require the key presses corresponding to letters "l' and "t", respectively. Also according to this principle, the word "thirst", may be divided in three portions, "thir", "s", and "t". For example, by considering that the phoneme set "thir" may already been assigned to the key comprising the letter "t" (e.g. key 8101), the user may press the key 8101, and say "thir', then he may press the key 8106 corresponding to the letter "s" and pronounce the sound of the phoneme "s". He then, may press the key 8101 corresponding to the letter 't" and pronounce the sound of the phoneme "t'. At the end of the word, the user may press an end-of the-word key such as a space key 8107.

Also for better disambiguation and also for reducing the number of phoneme-sets necessary for words having for example, the same speech at their beginning (e.g. "bring" and "brings"), in addition to pressing the first key of a syllable, and speaking said syllable, in some cases one or more character such as the last character(s) (e.g. "s") of a word/syllable may be pressed and spoken. For example, a user may press a key corresponding to the character "b" and say "bring" (e.g. phoneme-set "bring" was assigned to the key "8102). He then, may press the key corresponding to the letter "s", and either pronounces "s" or speaks the sound of the phoneme "s'. After providing an end-of-the-word signal such as pressing the "space" key, the system will considers the two data input sequences, and provides the corresponding word "brings" (e.g. its phoneme set was not assigned to the key

8102). It is understood that entering one or more single character(s) by using the method here, may be possible in any position (such as in the beginning, in the middle, or at the end) within a word. For not confusing the system, when a user enters a portion (of a word) comprising a letter, by the word entry system of the invention, he preferably may speak the sound of said letter. For example, instead of saying "em", the user may pronounce the sound of the phoneme "m". Also in a similar case, speaking saying "t", may be related by the system to the chain of characters "tea', "tea" and the letter "t", while pronouncing the sound of the phoneme "t', will be related to only the letter "t".

As described before, for better disambiguation, a word/portion-of-a-word/syllable-of-a-word/sub-speech-of-a-word (such as "thirst" or "brings") having substantial number of phoneme sets may be divided into more than one portion wherein some of said portions may contain one phoneme/character only, and entered according to the data entry system of the invention. Also as mentioned, according to this approach, multiple phoneme-sets wherein each comprising fewer number of phonemes may replace a single phoneme-set comprising substantial number of phonemes, for representing a portion of a word (e.g. a syllable). Also as described before, dividing the speech of a long portion (e.g. long syllable comprising substantial number of phonemes) of a word into shorter sub-speech/phoneme-set portions, will reduce the total number of phoneme-sets necessary for recognition of all of the words available in a dictionary data base. As also described before, this will permit to assign less phoneme-sets to each key of the keyboard/keypad.

According to one embodiment of the invention, based on the above-mentioned principles, to each key of a keyboard/keypad short phoneme-sets comprising few phonemes may be assigned. For this purpose, for example, if a phoneme-set starts with a consonant it may comprise following structures/phonemes:

- only said consonant
- said consonant at the beginning, and at least one vowel after that
- said consonant at the beginning, at least one vowel after said consonant, and one consonant after said vowel(s)

If the phoneme-set starts with a vowel, it may have the following structures:

- at least one vowel at the beginning
- said vowel(s) at the beginning, and one consonant after that

Fig. 88 shows some examples of the phoneme-sets 8801 for the constant "t" 8802 and the vowel "u' 8803, according to this embodiment of the invention. Columns 8804, 8805, 8806, show the different portions of said phoneme-sets according to the sound groups (e.g. consonant/vowel) constituting said phoneme-set. Column 8807 shows corresponding exemplary words wherein the corresponding phoneme-sets constitute part of the speech of said words. For example, phoneme set "tār" 8808 constitutes portion 8809 of the word "stair". Column 8810 shows an estimation exemplary of the number of key presses for entering the corresponding words (one key press corresponding to the first character of each portion of the word according to this embodiment of the invention). For example, to enter the word 'until" 8811, a user will first press the key 8101 (see fig. 81) corresponding to the letter "u" and preferably simultaneously, says "un". He then presses again the key

8101 corresponding to the letter "t", and also preferably simultaneously, says "til". To end the word, the user then informs the system by an end-of-the-word signal such as pressing a space key. The word until was entered by two key presses (excluding the end-of-the-word signal) along with the use's speech. According to the current embodiment based on the principles described before, a consonant phoneme which has not a vowel, immediately, before or after it, may be considered as a separate portion of the speech of a word. For example, the "s" at the beginning of the word "study" 8812, and the "s" in the middle of the word "understood" 8813 may follow this rule. This will extremely reduce the number of phoneme-sets necessary for entering of any word available in a dictionary (e.g maybe less than one hundred phoneme-sets per the beginning phoneme/character of a portion of a word may be enough for recognition of all of the words in for example, the English language). Fig. 88 shows other beginning phonemes/characters such as "v" 8814, and "th" 8815 assigned to the key 8101 of a telephone-type keypad. For each of said beginning phonemes/characters, phoneme-sets according to the above-mentioned principles may be considered. It is understood that if needed/desired longer sub-speech portions of a word, having more phonemes may also be considered with the short phoneme-sets of the system. Also for examples, phoneme sets representing more than one syllable of a word may also be considered. Also for easier recognition, as described in previous embodiments, to permit better recognition of the speech pronounced by the users that, in many cases, may be natives of non English spoken regions, character-sets corresponding to phoneme sets (such as "tō" and "tô") having ambiguously similar pronunciation, may be assigned to all of said phoneme-sets.

Memorized short phoneme-sets/speech-models may permit the recognition and entry of words in many languages. For example, the phoneme set "sha", may be used for recognition of words such as:

"shadow", in English,
"chaleur", in French,
"shalom', in Hebrew,
"shabab", in Arabic,
"Geisha", in Japanese, Etc.

To each of said phoneme sets, corresponding character-sets in a corresponding language may be assigned. As mentioned before, by doing so, a powerful multi-lingual data entry system based on phoneme-set recognition may be provided. For this purpose one or more data bases in different languages may be available within the system. Different methods to enter different text in different languages may be considered.

According to one method, by having a common short phoneme-sets data base and the corresponding character-sets database in many languages, for entering text in a desired language, a user may select a language mode by informing the system by a predefined means. For example, said user may press a mode key to enter into a desired language mode. In this case after entering a word by entering the portions of a said word according to a corresponding embodiment of the invention, the system will compare the selected corresponding groups/chains of assembled character-sets with the words of a dictionary of words corresponding to said selected desired language. After matching said group of

characters with one or more words of said dictionary, the system selects said matched word(s) as the final selection to be inputted/outputted. If the selection contains one word, said word may become the final selection. If the selection comprises more than one word, then said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example using a "select" key.

According to another method, all data bases in different languages available with the system will be used simultaneously, permitting to enter an arbitrary word entry in different languages. For example, after entering a word by entering the portions of a said word according to one embodiment of the invention, the system will compare the selected corresponding groups of characters with the words of a all of the dictionaries of words available with the system. After matching said group of characters with the words available in different dictionaries available with the system, the system selects said matched word(s) as the final selection to be inputted/outputted. If the selection contains one word, said word may become the final selection. If the selection comprises more than one word, then said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example using a "select" key.

In some languages such as Hebrew or Arabic, wherein most of the vowels are not presented by separate characters, the system may even work with higher accuracy.

The system may also work without the step of comparison of the assembled selected character-sets with a dictionary of word. This is useful for entering text in different languages without worrying about their existence in the dictionary of the words of the system. For example, if the system does not comprise a Hebrew dictionary of words, a user may enter a text in Hebrew language by using the roman letters. To enter the word "Shalom", the user will use the existing phoneme sets "sha" and "lom" and their corresponding character sets available within the system. A means such as a mode key may be used to inform the system that the assembled group of characters will be inputted/outputted without said comparison. If more than on assembled group of characters has been produced, they will be may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key.

In the word entry embodiments of the invention, if the inputted/outputted word is not the one desired by the user, a word-erasing function may be assigned to a key. Similar to a character erasing function (e.g. delete, backspace) keys, pressing a word-erase-key will erase the word before the cursor on the display.

According to another embodiment of the invention, most phoneme-sets of the system will have only one consonant. Fig. 89 shows some of them as example. According to this embodiment, for example, to enter the word "teabag" 8901, the user first presses the key 8101 while saying "tē". He then presses the key 8102 while saying "ba". He finally presses the key 8103 while saying "g" (or pronouncing the sound of the phoneme "g"). As in other embodiments, at the end of the word he may press a key such as space key.

For better response and to augment the accuracy of the system, an auto-correction software may be combined with the embodiments of the invention. Auto correction software are known by the people skilled in the art. For example, when a user tries to enter the word "network", he first presses the key 8108 of the keypad to which the letter "n" is assigned and simultaneously says "net". To the same key 8108 the letter "m" is also assigned. In some situations, the system may misrecognize the user's speech and select a character set such as "met" for said speech. The user proceeds to entering the next syllable by pressing the key 8104 corresponding to the first letter, "w", of said syllable and says "work". The system recognizes the phoneme set "work" pronounced by the user and selects a corresponding character set "work". Now the system assembles the two selected character sets and gets the word "metwork". By comparing this word with the words existing in the dictionary of the words database of the system, the system can not match said assembled word with any of said words of said database. The system then will try to match said assembled word with the most resembling word. In this case, according to one hypothesis the system may replace the letter "m" by the letter "n", providing the word "network", which is available in said dictionary. According to another hypothesis, by considering that "m", and "n" may be misrecognized by the voice recognition system and both are located on a same key, the system will replace the phoneme set "met' by the "phoneme set "net' and select the character set "net' assigned to the phoneme set "net". Then, by replacing the character set "met" by the character set "net', the word 'network" will be assembled. Said word is available in the dictionary of the words of the system. It will finally be selected.

In another example, entering "that" may be recognized as "vat" by the system. Same procedure will disambiguate said word and will provide the correct word, "that".

In another example, if the system does not match an assembled group of characters with a word of the dictionary, the auto-correction software of the system may evaluate the position of the characters of said assembled character-set (relating to each other) in a corresponding portion (e.g. syllable) and /or within said assembled group of characters, and tries to match said group of characters to a word of the dictionary. For example, if a character is missing within said chain/group of characters, by said comparison with the words of the dictionary, the system may recognize the error and output/input the right word. For example, if a user enters the word "un-der-s-tand" (e.g. in 4 portions), and forgets to enter the portion "s" of said word, one of the assembled group of characters may be the chain of characters "undertand". By considering the characters of said chain of characters and their position relating to each other in said chain, and comparing said chain of characters with the words of the dictionary, the system may recognize that the intended word is the word "understand" and eventually either will input/output said word or may present it to the user for user's decision. The auto-correction software of the system may have part of, or all of the functionalities any auto-correction software known by the people skilled in the art.

Words such as "to', "too", or "two", having the same pronunciation, may follow special rules. For example, the most commonly used word among these words is the word "to". This word may be entered according to the embodiment of the invention. The output for this operation will be the word "to" by default. The word "too', may be entered (in two

syllables) by pressing the key corresponding to the letter "t", while saying "tōō". Before pressing the end-of-the-word key, the user may also enter an additional character "o", by pressing the key corresponding to the letter "o", and saying "o". Now he may press the endpoint key. The word "too" will be recognized and inputted. To enter the word "two", the system may either enter it character by character, or assign a special speech such as "tro" to said word and enter it using this embodiment. Also for example, to enter "two", the user may press the key 8101 and pronounce a long "tōō ". To enter the digit "2", the user presses the corresponding key 8102, and pronounces said digit.

A very interesting issue has just been mentioned. For example, by saying "fīv" and pressing the key 8109 corresponding to the first letter of the word "five", the word "five" will be entered. Interestingly, by saying "fīv" and pressing the key 8105 corresponding to the digit "5", the digit "five" will be entered. By saying a word having two different output symbols, and using key presses, the user intention is clarified. This is one of the shortcomings of the data entry by the speech alone wherein the user intention may not be considered by the voice/speech recognition system. Also for example, to a same digit, more than one speeches may be assigned. For example, to the digit "4", two speeches, "four", and "forty", may be assigned. A user may produce the number "45", by either saying "four", "five" while pressing the corresponding keys, or he may say "forty five" while pressing the same keys. Also when a user presses the key 8106 and says "seven", the digit "7" will be inputted. This is because to enter the word "seven", the user may press the key 8106, and say "se". He then may press the key 8101 and say 'ven".

In other languages such as French, wherein the speech of the digit "7", comprises one syllable, for disambiguation purpose, a custom made speech having two syllables may be assigned to the character set "sept". For example, the word "septo" may be created by a user and added to the dictionary of the word. This word may be pointed to the word "sept" in the dictionary. When a user enters the word "septo" (according to the current embodiment of the invention) the system will find said word in the dictionary of the words of the system. Instead of inputting/outputting said word, the system will input/output the word pointed by the word "septo". Said word is the word "sept". The created symbols pointing to the words of the dictionary data base may be arranged in a separate database It must be noted that the sub-speech-level data entry system of the invention is based on the recognition of the speech of at least part of a word (e.g. sub speech of a word). Considering that many words in one or more languages may have common sub-speeches, by slightly modifying/adding phoneme sets and assign the corresponding characters to said phoneme sets, a multi-lingual data entry system may become available. For example, many languages such as English, German, Arabic, Hebrew, and even Chinese languages, may comprise words having portions/syllables with similar pronunciation.

It is understood that a user may add new standard or custom-made words and corresponding speech to the dictionary database of the system. accordingly, the system may produce corresponding key press values and speech models and add to corresponding databases.

As mentioned before, to enter a word, a user may press a key corresponding to the first character/letter of a first portion of a word and speak (the phonemes of) said portions. If said word is spoken in more than one portions, the user may repeat this procedure for each of the remaining portions of said word.
According to one embodiment of the invention, when the user presses a key corresponding to the first letter of a portion (such as a syllable) of a word and speaks said portion, the voice/speech recognition system hears said user's speech and tries to match at least a portion (preferably, at least the beginning portion) of said speech to the phoneme sets assigned to said key. The best matched phoneme sets are selected and the corresponding character sets will be selected by the system. After entering the entire word by repeating the same procedure for each portion (e.g. syllable) of said word, one or more character sets for each portion (e.g. syllable) of said word may be selected, respectively. The system now, may have one or more character sets for each portion (syllable) of a word wherein each character set may comprise at least part of the (preferably, the beginning) characters of said syllables. The system then, will try to match each of said characters sets to the (e.g. beginning) characters of the corresponding syllables of the words of a dictionary of the words data base of the system. The best matched word(s) will be selected. In many cases only one word of the dictionary will be selected. Said word will be inputted/outputted. If more than one word available is selected, said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key.

For example, by using the table of the fig. 85, to enter the word "trying" (e.g. phonemes "trĩ-ing), the user may first press the key 8101 and say "trĩ". The system matches the user's speech to the corresponding phoneme set assigned to the key 8101 and selects the corresponding character sets (e.g. in this example, "try", "tri"). The user then presses the key 8103 corresponding to the character "i" and says "ing". In this case, the system matches the beginning of the user's speech to the phoneme set "in" assigned to the key 8103 (e.g. phoneme set "ing" does not exist in the exemplary data base, therefore it is not assigned to said key) and selects the corresponding character set "in". The user now has finished to enter the word and he enters an endpoint (e.g. end of the word) symbol such as pressing a space key or pressing any key without speaking (e.g. pressing a key and not speaking may be assigned to characters such as punctuation marks, PC functions, etc. This matter has already been explained in the PCT applications that have already been filed by this inventor). The system now may create different groups of characters each comprising possible characters of at least part of the beginning characters of each syllable of the desired word. In this example, two group of characters may be created. Said groups of characters are:

"tri - in "

and;

"try - in "

Only the second group of characters (e.g. "try in") corresponds to an existing word in the English dictionary wherein said word comprises the letters "try" at the beginning of its first

syllable, and also comprises the letters "in" at the beginning of another (e.g. second) syllable of said word. Said word is the word "trying".

In this system the quantity of phoneme sets/speech models necessary for recognition of many entire words may dramatically be reduced. On the other hand the number of the sets of character representing said phoneme sets may be augmented but will not have a significant impact on the amount of memory needed.

In many cases only one of said assembled characters may match a word in the dictionary. Said word will be inputted/outputted. If more than one assembly of character sets correspond to words available in the dictionary, said words may be presented to the user (e.g. in a list printed at the display) and the user may select one of them by for example pressing a "select" key.

As mentioned before, the system may select a word according to one or more of said selected character/phoneme sets corresponding to speech/sub-speech of said word.

In some cases, the system may not consider one or more of said selected character/phoneme sets, considering that they were erroneously selected by the system. Also, according to the needs, the system may consider only part of the characters/phonemes of a phoneme/character set selected by the system. For example, if the user attempts to enter the word "demonstrating", in four portions "de-mons-tra-ting", and the system erroneously selects the character sets, "des-month-tra-ting", according to one recognition method (e.g. comparison of said character/phoneme sets with the words of the dictionary), the system may not find a word corresponding to assembly of said sets of characters. The system then, may notice that by considering the letters "de" (e.g. few begging letters) of the first selected character-set and the letters "mon" (few begging letters) of the second character-set, also considering the third and forth character sets, the intended word may be the word "demonstrating". Also as needed, the system may add characters to an assembled (of the selected character sets) chain of characters or delete characters from said chain of characters to match it to a best matching word of the dictionary. For example, if the user attempts to enter the word "sit-ting", in two portions, and the system erroneously selects the character sets, "si-ting", according to a recognition method (e.g. comparison of said character/phoneme sets with the words of the dictionary), the system may decide that a letter "t" must be added after the letter "i", within said chain of characters to match it to the word "sitting". In another example, if the user attempts to enter the word "mee-ting", in two portions, and the system erroneously selects the character sets, "meet-ting", according to a recognition method (e.g. comparison of said character/phoneme sets with the words of the dictionary), the system may decide that a letter "t" must be deleted after the letter "e", in said chain of characters to match it to the word "meeting".

Having a same phoneme at the end of a portion of a word (e.g. said word having more than one portion/syllable) and at the beginning of the following portion of said word may permit better recognition accuracy by the system.

According to one embodiment of the invention, for example, to phoneme-sets (assigned to a key) terminating with a phoneme such as a vowel, additional phoneme-sets comprising said phoneme-set and an additional phoneme such as a consonant at its end may be considered and assigned to said key. This may augment the recognition accuracy. For example, by referring to Fig. 81, when entering the word "coming" comprising two portions "co-ming", the user may press the keys 8102 say "co", then he may immediately press the key 8108 and say "ming". Because the first portion of the sub-speech is too short, if the phoneme-set "com" is not assigned to the same key 8102 wherein the phoneme-set "co" is assigned, while pressing said key and saying "co", it may happen that the system may misrecognize the speech of said portion by the user and select an erroneous phoneme-set such as "call". On the other hand if the phoneme-set 'com" is also assigned to said key, the beginning phoneme "m" of the portion "ming" would be similar to the ending phoneme "m" of the phoneme-set "com". In this case the system may select two phoneme-sets "com-ming" and their corresponding character-sets, (e.g. "com/come", and "ming" as example). After comparing the assembled character-sets with the words of the dictionary, the system may decide to eliminate one "m" in one of said assembled character-set and match said assembled character-set it to the word "coming" of the dictionary database.

To permit better recognition of the speech pronounced by the users that, in many cases, may be natives of non English spoken regions, character sets assigned to phoneme sets (such as "vo" and "tho") having ambiguously similar pronunciation, may be assigned to all of said phoneme sets.

Entering data such as text through a small keypad severely reduces the data entry speed. The data entry systems of the invention based on pressing a single key for each portion/syllable of a word, while speaking said portion/syllable dramatically augments the data entry speed. The system has also many other advantages. One advantage of the system is that the system may recognize (with high accuracy) a word by pressing maybe a single key per each portion (e.g. syllable) of said word. Another great advantage of the system is that the users do not have to worry about misspelling/mistyping a word which, particularly, in word predictive data entry systems result in misrecognition/non-recognition of an entire word. Also another great advantage of the system is in that when a user presses the key corresponding to the first letter of a portion of a word, he speaks (said portion) during said key press. At the end of a word, the user may enter a default symbol such as a punctuation mark (assigned to a key) by pressing said key without speaking. As mentioned before, this key press may also be used as the end-of-the-word signal. For example, a user may enter the word "hi", by pressing the key 8103 and simultaneously say "hi". He then may press the key 8107 without speaking. This will inform that the entry of the word is ended and the symbol "," must be added at the end of said word. The final input/output will be the character set "hi,".

The data entry system described in this invention is a derivation of the data entry systems described in the PCTs and US provisional applications filed by this inventor. The combinations of a character by character data entry system providing a full PC keyboard function as described in the previous applications and a word/portion-of-a-word level data entry system as described in said PCT application and here in this application will provide

a complete fast, easy and natural data entry in mobile (and even in fix) environments permitting quick data entry through keyboards having reduced number of keys (e.g. keypads) of small electronic devices.

As mentioned before, the data entry system of the invention may use any keyboard such as a PC keyboard. Also as mentioned, according to the data entry system of the invention, a symbol on a key of a keyboard may be entered by pressing said key without speaking. The data entry system of the invention may optimistically function with a keyboard such as a standard PC keyboard wherein a single symbol is assigned to a predefined pressing action on one or more keys. As is known by people using computer keyboards such as the one shown in Fig. 90, for example, by pressing a key 9001 of a PC keyboard 9000, the letter "b" may be entered. Also for example, by pressing, simultaneously, the shift key 9002 and the key 9003, the symbol "#" may be entered.

By combining the data entry system of the invention with such a keyboard, on one hand a user may use said keyboard as usual by pressing the keys corresponding the desired data without speaking said data (this permits to enter single letters, punctuation characters, numbers, commands, etc., without speaking), and on the other hand, said user may enter a desired data (e.g. word/part-of-a-word) by speaking said data and pressing (preferably simultaneously) the corresponding key(s). For example, by using a keyboard such as a PC keyboard, to enter the letter "b", the user may press the key 9001 without speaking. To enter the word/syllable "band", the user may press the key 9001 and (preferably, simultaneously) say "band". Without the necessity of additional manipulation for changing modes, this, on one hand permits the user to work with the keyboard as usual, and on the other hand enables said user to enter a macro such as a word/part-of-the-word by speaking said macro and (preferably, simultaneously) pressing the corresponding one or more key.

As mentioned before, the combinations of a character by character data entry system providing a full PC keyboard function as described in the previous applications and a word/portion-of-a-word level data entry system as described in said PCT application and here in this application will provide a complete fast, easy and natural data entry system.

Speech of a word may be comprised of one or more sub-speeches also corresponding to single characters. For example, by referring to Fig. 81, when a user presses the key 8102 of the keypad 8100 and says "b", said data entered, may correspond to the letter "b", the word "be", and the word "bee". According to one embodiment, the system may assign the highest priority to the character level data, considering (e.g. in this example, the letter "b") as the first choice to eventually being inputted/presented to the user. If this is not what the user intended to enter, he then may either continue to enter the rest of the word, character by character, or he, for example, may press an end key to finish the entry of said word and then for example, manipulate a select-key to navigate between the other choices (e.g. "be", and "bee", in this example) and select the one he desires.

According to this method, also for example, while entering a word/chain-of-characters starting with a sub-speech corresponding to a single character and also eventually

corresponding to the speech of a word/part-of-a-word assigned to said key, said character may be given the highest priority and eventually being printed on the display of a corresponding device, even before the end-of-the-word signal is inputted by the user. If the next part-of-the-speech/sub-speech entered, may still correspond/also-correspond to a single letter, this procedure may be repeated. If an end-of-the-word signal such as a space key occurs, said chain of characters may be given the highest priority and may remain on the display. Proceeding to a next task, such as entering the next word, will be considered as confirmation of acceptance of said chain of characters by the user. If the same data entered also corresponds to one or more words matched by the system, said words may also be available/presented to the user. If said printed chain of single characters is not what the user intended to enter, the user may, for example, use a select key to navigate between said words and select the one he desires.

With continuous description of this embodiment of the invention, if one of the data (speech/part-of-the-speech and/or key press) entered during entering a word/part-of-a-word, does not correspond to a single character and at the end-of-the-word signal has been inputted, then said displayed characters may be erased and instead, the word (corresponding to said data) with highest priority may be presented to the user. If the same data entered also corresponds to more words, said words may also be presented to the user, if he desires. In this case, the user may, for example, use a select key to navigate between said words and select the word he desires.

By using a standard telephone keypad and the data entry of the system of the invention, there may notice that in English language there are no words with more than one syllable wherein the speech of all of said syllables also correspond to single letters on the corresponding keys.

There are several one-syllable words which correspond to a character on a corresponding key (e.g. "b, be, bee", or "t, tea, tee"). As mentioned, in those cases, said single letters may be given the highest priority.

According to the above-mentioned principles, for example:

- to enter "b", the user presses the key 8102 and says "b"
- to enter "bmx", the user presses the corresponding keys while pronouncing the corresponding letters
- to enter "bmx95", the user presses the corresponding keys and pronounces the corresponding characters
- to enter the word "before", the user either presses the corresponding keys while pronouncing the corresponding letters (e.g. character by character data entry), or for example, he first presses the key 8102 and (preferably, simultaneously) says "bē" and then he presses the key 8109 and says "for". At the end he enters an end-of-the-word signal such as pressing a space key (e.g. word/portion-of-a-word data entry system).

The advantage of this method is in that the user may combine character by character data entry of the invention with the word/part-of-the-word data entry system of the invention, without switching between different modes.

The data entry system of the invention is a complete data entry system enabling a user at any moment to either enter arbitrary chain of characters comprising symbols such as letters, numbers, punctuation characters, (PC) commands, or enter words existing in a dictionary database.

According to one embodiment of the invention, the character-sets (corresponding to the speech of a word/part-of-a-word) selected by the system may be presented to the user before the procedure of assembly and comparison with the word of the dictionary database is started. For example, after each entry of a portion of a word, the character-sets corresponding to said entered data may immediately be presented to the user. The advantage of this method is in that immediately after entering a portion of a word, the user may verify if said portion of the word was misrecognized by the system. In this case the user may erase said portion and repeat (or if necessary, enter said portion, character by character) said entry until the correct characters corresponding to said portion are entered. Instead of erasing one by one the characters corresponding to an entered portion of a word, a key permitting to erase the entire characters corresponding to said portion may be provided. According to one embodiment of the invention, a same key may be used to erase an entire word and/or a portion of a word. For example, a single press on said key may result the erasing an entered portion of a word (e.g. a cursor situated immediately after said portion by the system/user indicates the system that said portion will be deleted). Also for example, a double press on said key may result in erasing all of the portions entered for said word (e.g. a cursor may be situated immediately after the the portions to be deleted to informs the system that all portions of a word situated before said cursor must be deleted).

It may happen that a user desires to enter a chain of characters such as "systemXB5" comprising entire word(s) and single character(s).

According to one embodiment, after each entry of the data corresponding to a portion of said chain of characters or at the end of the entry of said entire chain of characters, the system may recognize that there is no word in the dictionary that corresponds to the selected character-sets corresponding to each portion of the word. In other hand the system may recognize that the assembly of some of sequential selected character-sets, correspond to a word in the dictionary database while the others correspond to single characters. In this case the system will form an output comprising of said characters and words in a single chain of characters. In the example above, the word "systemXB5" may be entered in five portions, "sys-tem-x-b-5".

For example, by using a telephone keypad such as the one shown in fig. 81, the selected character-sets corresponding to the key press and speech of each portion may be as follow:

portion	sys	tem	x	b	5
character-set	sis/sys	tem/theme/	x	b/be/bee	5

After assembly/comparing said portions with the words of a dictionary, the system may recognize that there is no word in the database matching the assemblies of said selected character-sets. Then the system may recognize that there are on one hand some portions corresponding to a single character, and on the other hands a single character-set or combination of successive other portions correspond to the word(s) in said database. The system then inputs/outputs said combination. In our example, the system may recognize that the assembly of a first and a second character-set "sys" and "tem", matches the word "system". The third and fifth character-sets correspond to the letter "x" and the number "5" respectively. The forth portion may correspond either to the letter "b", or to the words "be" and "bee".

The system may present to the user the following choices according their priority:

"systemxb5"
"systemxbe5"
"systemxbee5"

It is understood that for easing the recognition procedure of chain of characters comprising single characters and an entire word, the user may signal the start/end of said words/characters in said chain by a predefined signal such as pressing a predefined key.

According to one embodiment of the invention, a word being divided into more than one portions for being inputted, may preferably, be divided in a manner that, when possible, the speech of said portions start with a vowel. For example, the word "merchandize" may be divided in portions "merch-and-ize". Also for example, the word "manipulate" may be divided into "man-ip-ul-ate".

Also for better results, the selected character-sets corresponding to a phoneme-set corresponding to the speech of a portion of a word may consider the corresponding phoneme-sets when said character-sets are compared with the words of the dictionary database. For example, in English language, the corresponding character-sets for the phoneme-set "ār" may be character-sets such as "air", "ar", and "are". The corresponding character-sets for the phoneme-set "är" may be "are", and "ar". In this example, both phoneme-sets have similar character-sets, "are", and "ar". In case of misrecognition of the input, the system may attempt for a disambiguation or correction procedure. Knowing to which phoneme-set a character-set is related, may help the system to better proceed to said procedure. For example, if the user intends to enter the word "ār", and the system erroneously recognizes said speech as "āb" (e.g. no meaning in this example). Relating character-sets for said erroneously recognized phoneme-set may be character-sets such as "abe", "ab". By considering said phoneme-set, the system will be directed towards the words such as "aim", "ail", "air", etc. (e.g. relating to the phoneme "ā"), rather than the words such as "an", "am" (e.g. relating to the phoneme "a").

As mentioned before, phoneme sets representing more than one syllable of a word may also be considered and assigned to a key. Also as mentioned before, an entire word may be entered by speaking it and simultaneously pressing a key corresponding to the first

phoneme/character of said word. Even a chain of words may be assigned to a key. It may happen that the system does not recognize a phoneme-ser (e.g. sub-speech), of a word having more than one sub-speech (e.g. syllable). In this case, two or more consecutive sub-speeches (e.g. syllables) of said word may be assigned to a key. Referring to fig. 81, for example, the word "da-ta" (e.g. wherein for example, the system misrecognises the phoneme-set "ta"), may be assigned to the key 8109. To enter said word, the user may press the key 8109 and say "data".

Press and speak data entry system of the invention permits to enter words, therefore an end-of-the-word procedure may automatically or manually being managed by the system or by the user, respectively.

As described before, there are at least two kinds of words being entered:

- Words being entered in one portion by a single sub-speech/speech (e.g. words having one syllable) combined with the corresponding key press(es)
- Words being divided into more than one portion (e.g. words having more than one syllable, or words having one syllable but comprising multiple consecutive consonants or vowels) and being entered by sub-speech/speech corresponding to each portion combined with the corresponding key press(es) for each portion.

According to one embodiment of the invention, when an entire word corresponding to an existing word in a database of the words of a language is entered and the user enters an end-of-the-word signal such as pressing an "End-of-a-Word" key, then said word will consider the result of said data entered for being inputted/outputted. According to predefined system design/mode, the system may consider to add or not to add a character such as a space character at the end of said result. If the system or the user, do not enter a symbol such as a space character or an enter-function after said word, the next entered word/character will be attached to the end of said word.

Example:
"FOR" followed by an "End-of-the-Word" key (no spacing), results "FOR"

According to another embodiment of the invention, when an entire word corresponding to an existing word in a database of the words of a language is entered and the user enters additional symbols such as at least a space character, at least a punctuation mark, or at least an "enter" function at the end of said word, then said word and said additional symbols are entered.

Examples:
"FOR" followed by an " " results "FOR "
"FOR" followed by a "," results "FOR,"
"FOR" followed by an "." results "FOR."

According to one embodiment of the invention, when a user enters a word corresponding to an existing word in a dictionary database of the words of a language and then said user enters a next word (without entering an end-of-the-word signal such as a space character between said two consecutive words) also corresponding to an existing word in the

dictionary, but the assembly of said two words does not correspond to a word in a dictionary of words database, then the system will automatically add a space character between said two words.

Example: "FOR" followed by "SOME" results "FOR SOME"

According to one embodiment of the invention, when a user enters a word corresponding to an existing word in a dictionary database of the words of a language and then said user enters a next word (without entering an end-of-the-word signal such as a space character between said two consecutive words) also corresponding to an existing word in the dictionary, and the assembly of said two words also correspond to a word in a dictionary of words database, then the system may present two choices to the user. A first choice may be the assembly of said two words (without a space character between them), and the second choice will be said two words comprising one (or more) space character between them. According to factors such as predefined system design, meaning of assembled and separate meaning of said words, phrase concept, etc., the system may give may a higher priority to one of said choices and may print it on the display of the corresponding device for user confirmation. The user, then, will decide which one to select. For example, proceeding to the entry of the next word/character will inform the user that the first choice was confirmed.

Example 1:
"FOR" followed by "GIVE" may result a first choice "FORGIVE"
"FOR" followed by "GIVE" may result a second choice "FOR GIVE"

Example 2:
"WORK" followed by "MAN" may result "WORKMAN"
"WORK" followed by "MAN" also may result "WORK MAN"

The above-mentioned procedure may be repeated for the following word(s) also corresponding to the same principles.

Example:
"WORKMAN" followed by "SHIP" may results "WORKMANSHIP"
"WORKMAN" followed by "SHIP" may also result "WORKMAN SHIP"

According to one embodiment of the invention, when a first word corresponding to an existing word in a database of the words of a language is entered and the user enters a next word/portion-of-a-word to the end of said first word (with no space character between them) and said next word/portion does not corresponds to an existing word in the dictionary, but said next word/portion assembled with said first word corresponds to a word in the dictionary, then the system will automatically attach said first word and said second word/portion to provide a single word.

Example:

"FOR" followed by "CING" results "FORCING"
"FORGIVE" followed by "NESS" results "FORGIVENESS"

According to one embodiment of the invention, when a first entered word/portion-of-a-word does not exist in a database of the words of a language and the user enters a next word/potion-of-a-word, the system will assemble said first and next portions and compares said assembly with the words in a dictionary. If said assembly corresponds to a word in said dictionary, then the system selects said word and eventually presents it to the user for confirmation.

Example:
"SYS" followed by "TEM" results "SYSTEM"

It is understood, that for better results, also for reducing the ambiguity, automatic end-of-the-word procedure may be combined with user intervention. For example, pressing a space key at the end of a portion, may inform the system that said portion must be assembled with at least one portion preceding it. The system may also place a space character at the end of said assembled word.

Example 1: without user intervention, the following situation may occur:
"FOR" followed by "GIVE" may result a first choice, "FORGIVE"
"FOR" followed by "GIVE" may result also a second choice, "FOR GIVE"

Example 2: with user intervention, the following situation may occur:
"FOR" followed by "GIVE" followed " " may result one choice, "FORGIVE "

Entering the system into a manual/semi-automatic/automatic end-of-the-word mode/procedure may be optional. A user may inform the system by a means such as a mode button for entering into said procedure or exiting from it. This is because in many cases the user may prefer to manually handle the end-of-the-word issues.

As mentioned in a previous embodiment, the user may desire to, arbitrary, enter one or more words within a chain of characters. This matter has already been described in one of the previous embodiments of the invention.

Example: "91SYSTEMep7"

According to one embodiment of the invention, the system may present to the user, the current entered word/potion-of-a word (e.g. immediately) after its entry (e.g. speech and corresponding key press) and before an "end-of-the-word" signal has been inputted. This will be a dynamic recognition processing. The system may match said portion with the words of the dictionary, relate said portion to previous words/portions-of-words, current

phrase context, etc., to decide which output to present to the user. The system may also, simply present said portion, as-it-is, to the user. This procedure may also enable the user to enter words without spacing between them. For example, after a selected result (e.g. word) presented to the user has been selected by him, the user may proceed to entering the following word/potion-of-a-word without adding a space character between said first word and said following word/portion-of-a word. The system will attach said two words.

Example:
"PRESS" followed by "SPEAK" results "PRESSSPEAK"

In additional to standard words in a dictionary, the word database of the system may also comprise abbreviations, words comprising special characters (e.g. "it's"), etc.

Referring to Fig. 81, for example, when a user presses the key 8103 and says "its", the system may select the words, "its", and "it's" assigned to said key and said (portion of) speech. The system may either itself select one of said words (e.g. according to phrase concept, previous word, etc.) as the final selection or it may present said selected words to the user for final selection by him. In this case the system, for example, may print the word with highest priority (e.g. "its") at the display of the corresponding device. If this is what the user desired to enter, then the user may use a predefined confirmation means such as pressing a predefined key or proceeding to entering the following data (e.g. text). Proceeding to entering the following data (e.g. text) may be considered by the system as the confirmation of the acceptance of the current proposed word. If said printed/proposed word is not what the user intended to enter, then the user may select the other selected words (e.g. "it's") by a selecting means provided within the system.

As mentioned in previous applications, symbols (e.g. speech/phoneme-sets/character-sets/etc.) may be assigned to a mode/action such as double-pressing on for example, a key, combined with/without speaking. According to one embodiment of the invention, an ambiguous word(s)/part-of-a-word may be assigned to said mode/action. For example, the words "tom" and "tone" (e.g. assigned to a same key 8101) may cause ambiguity when they are pronounced by a user. One solution to disambiguate them may be in assigning each of them to a different mode/action. For example, a user may single press (e.g. pressing once) the key 8101 and say "tom" to enter the character-set "tom" of the example. Also said user may double-press the key 8101 and say "ton" to enter the character-set "tone" of the example.

Also for example, a first phoneme-set (e.g. corresponding to at least part of the speech of a word) ending with a vowel may cause ambiguity with a second phoneme-set which comprises said first phoneme-set at the beginning of it and includes additional phoneme(s). Said first phoneme-set and said second phoneme-set may be assigned to two different modes. This may significantly augment the accuracy of voice/speech recognition, in noisy environments. For example, the phoneme-set "ma" may cause ambiguity with the phoneme-set "mall" when they are pronounced by a user. For better disambiguation, each of them may be assigned to a different mode. For example, the phoneme-set "ma" may be

assigned to a single-press of a corresponding key and the phoneme-set "mall" may be assigned to a double-press on said corresponding key.

According to another embodiment of the invention, the symbols (e.g. phoneme-sets) causing ambiguity may be assigned to different corresponding modes/actions such as pressing different keys. Although obviously it is not convenient, in the example above, the first phoneme-set "ma" may, for example, be assigned to a first key such as 8101, and the second phoneme-set "mall" may be assigned to another key.

Also, according to one embodiment of the invention, a first phoneme-set represented by a at least a character representing the beginning phoneme of said first phoneme-set may be assigned to a first action/mode, and a second phoneme-set represented by at least a character representing the beginning phoneme of said second phoneme-set may be assigned to a second action/mode, and so on. For example, the phoneme-sets starting with a representing character "s" may be assigned to a single press on the key 8101, and the phoneme-sets starting with a representing character such as "sh" or "t", may be assigned to a double press on, the same key 8101, or another key.

According to one embodiment of the invention, single letters (e.g. "a" to "z") may be assigned to a first mode/action and words/portion-of-words may be assigned to a second action/mode. For example, a single letter may be assigned to a single press on a corresponding key (e.g. combining with user's speech of said letter), and a word/portion-of-a-word may be assigned to a double press on a corresponding key. According to this example, a user may combine a letter-by-letter data entry and a word/part-of-a-word data entry. For this purpose, on one hand, said user may provide a letter-by-letter data entry by single presses on the keys corresponding to the letters to be entered while speaking said letters, and on the other hand, said user may provide a word/part-of-a-word data entry by double presses on the keys corresponding to the word/part-of-a-word to be entered while speaking said word/part-of-a-word.

According to one embodiment of the invention, a means such as a button press may be provided for the above-mentioned purpose. For example, by pressing a mode button the system may enter into a character-by-character data entry system and by re-pressing the same button or pressing another button, the system may enter into a word/part-of-a-word data entry system. According to this embodiment, in a corresponding mode, a user may for example, enter a character or a word/part-of-a-word by a single pressing action on a corresponding key and speaking the corresponding character (e.g. letter) or word/part-of-a-word.

Also words/portion-of-words having similar pronunciation may be assigned to different modes, for example, according to their priority, in general, or in the corresponding phrase. In this case, for example, a first word/portion-of-word may be assigned to a mode such as a single press, and a second word/portion-of-word may be assigned to a mode such as a double press on a corresponding key, and so on. For example, words "by" and "buy" have similar pronunciations. A user may enter the word "by" by a single press on a key assigned to the letter "b" and saying "bī". Said user may enter the word "buy" (e.g. having lower

priority, in general) by applying a double press on a key corresponding to the letter "b" and saying "bī". Also for example, the syllable/character-set "bi" (also pronounced "bī"), may be assigned to a third mode such as a triple tapping on a key, and so on.

As mentioned before, the different assembly of selected character-sets relating to the speech of at least one portion of a word may correspond to more than a word in a dictionary data base. Also as mentioned before, a selecting means such as a "select-key" may be used to select an intended word among those matched words. A higher priority (when there are more than one selected words) may be assigned to a word according to the context of the phrase to which it belongs. Also, higher priority (when there are more than one selected words) may be assigned to a word according to the context of at least one of the, previous and/or the following portion(s)-of -words/words.

According to one embodiment of the invention, each of said matched words may be assigned to a different mode of the data entry system of the invention. For example, when a user presses a key corresponding to the letter "b" and says "bē", two words "be" and "bee" may be selected by the system. To avoid the use of for example, a "select-key", according to this embodiment, a first selection "be" may be assigned to a mode such as a single-press mode and a second selection 'bee" may be assigned to a mode such as a double-press mode. According to this embodiment, in the example above, a user may press once the key corresponding to "b" and says "bē" to provide "be". He also, may double press the same key and say "bē" to provide "bee".

According to one embodiment of the invention, some of the spacing issues may also be assigned to a mode such as a single-press mode or a double-press mode. For example, in automatic spacing procedure, the attaching/detaching (e.g. of portions-of -words/words) functions may be assigned to a double-press mode. According to this embodiment, a word/portion-of-a-word assigned to this mode may be attached to a word/portion entered before or being entered after this word/portion. For example, when if a user enters a word such as the word "for" by a single press (e.g. while speaking it), a space character may automatically be provided before (or after, or both before and after) said word. If same word is entered by a double-press (e.g. while speaking it), said word may be attached to the previous word/portion-of-word, or to the word/portion-of-word entered after it.

In the example above, also for example, a double press after the entry of a word/portion-of-a-word may cause the same result.

According to one embodiment of the invention, for automatic spacing purposes, some of the words/part-of-the-words assigned to corresponding phoneme-sets, may include at least one space character at the end of them. In this case, when said space is not required, it may, automatically, be deleted by the system. Characters such as punctuation marks, entered at the end of a word may be located (e.g. by the system) before said space. For example:

"word " followed by "," results "word, "

According to another embodiment of the invention, for automatic spacing purposes some of the words/part-of-the-words assigned to corresponding phoneme-sets, may include at least one space character at the beginning of them. In this case, when said space is not required (e.g. for the first word of a line), it may be deleted by the system. Because the space character is located at the beginning of the words, characters such as single letters or the punctuation marks may, as usual, be entered at the end of a word (e.g. attached to it).

According to one embodiment of the invention, during data entry including automatic spacing procedure, an action such as a key press for attaching the current portion/word to the previous/following portion/word may be provided. For example, if a space is automatically provided between two (e.g. current and precedent) words/portions, a predefined action such as a key press may eliminate said space and attach said two words/portions. Example:

"for" + " give" + a predefined key-press, results "forgive"

According to another embodiment of the invention, a longer duration of pronunciation of a vowel of a word/syllable/portion-of-a-word, ending with said vowel, may cause a better disambiguation procedure by the speech recognition of the invention. For example, pronouncing a more significant laps of time, the vowel "ô" when saying "vo" may inform the system that the word/portion-of-a-word to be entered is "vô" and not for example, the word/portion-of-a-word "vôl".

According to one embodiment of the invention, by using a predefined means such as a predefined key pressing action, the data to be inputted may be capitalized. For example, by pressing a "Caps Lock" key the letters/words/part-of-words entered by a user may be inputted/outputted in uppercase letters.

According to one embodiment of the invention, a letter/word/part-of-word in lowercase may be assigned to a first mode such as a single press on a corresponding key (e.g. combined with/without the speech of said letter/word/part-of-word) and a letter/word/part-of-word in uppercase may be assigned to a second mode such as a double press on a corresponding key (e.g. combined with/without the speech of said letter/word/part-of-word). For example, to provide the word (e.g. character-set) "thought", a user may single press the key 8101 and say "thought". To produce the word (e.g. character-set) "THOUGHT", said user may double press the key 8101 and say "thought". This may permit to locally capitalize an input.

Also, according to a similar principle, a word/part-of-word having its first letter in uppercase and the rest of it in lowercase, may be assigned to a mode such as a single-press mode, double-press mode, etc.

According to one embodiment of the invention, as described in previous applications for character-by-character data entry, a letter/word/part-of-a-word may be assigned to more than one single action, such as pressing two keys simultaneously. For example, a word/part-of-a-word starting with "th", may be assigned to pressing simultaneously, two

different keys assigned to the letters "t" and "h" respectively, and (eventually) speaking said word/part-of-a-word. Same principles may be assigned to words/parts-of-words starting with "ch", "sh", or any other letter of an alphabet (e.g. "a", "b", etc.).

According to one embodiment of the invention, words/part-of-a-words starting with a phoneme represented by a character may be assigned to a first mode such as a single press on a corresponding key, and words/part-of-a-words starting with a phoneme represented by more than one character nay be assigned to a second mode such as a double-press on a corresponding key. For example, words/part-of-words starting with "t" may be assigned to a single-press on a corresponding key (e.g. combined with the speech of said words), and words/part-of-words starting "th" may be assigned to a double-press on said corresponding key (e.g. combined with the speech of said words).

As mentioned before, depending on different embodiments of the invention, in different categories different dictionaries such as dictionary of words in one or more languages, dictionary of syllables/part-of-words (character-sets), dictionary of speech models (e.g. of syllables/part-of-words), etc., may be used. If necessary, two or more dictionaries in each or in whole categories may be merged. For example, a dictionary of words and a dictionary of part-of-words may be merged.

As described before, the data entry system of the invention may use any keyboard and may function with many data entry systems such as "multi-tap" system, word predictive systems, virtual keyboards, etc. For example, on one hand, a user may enter text (e.g. letters, words) using said other systems by pressing keys of the corresponding keyboards, without speaking (e.g. as habitual) the input, and on the other hand, said user may enter data such as text (e.g. letters, words/part-of-words), by pressing corresponding keys and speaking said data (e.g. letters, words/part-of-words, other characters such as punctuation marks, etc.).

As mentioned before, the data entry system of the invention may use any voice/speech recognition system and method for recognizing the spoken symbols such as characters, words-part-of words, phrases, etc. The system may also use other recognition systems such as lip-reading, eye-reading, etc, in combination with user's actions recognition systems such as different modes of key-presses, finger recognition, fingerprint recognition, finger movement recognition (e.g. by using a camera), etc. These recognition systems and user's actions have been described in previous patent applications by this inventor. All of the features in said previous applications (e.g. concerning the symbol-by-symbol data entry) may also be applied to macros e.g. word/portion-of word by word/portion-of-word) data entry system of the invention.

According to another embodiment of the invention, (as described in previous applications concerning the character-by-character entry level) a user may speak words/part-of-words without pressing the corresponding keys. On the other hand, said user may press a key to inform the system of the end/beginning of a speech (e.g. a character, a part –of-a-word, a word, a phrase, etc.), a punctuation mark, a function, etc.

The data entry system of the invention may also be applied to the entry of macros such as more-than-a-word sequences, or even to a phrase entry system. For example, a user may speak two words and press a key corresponding to the first letter of the first word of said two words.

Although in many paragraphs in this application and in the previous applications, for data entry purposes, key presses combined with voice/speech of the user have been mentioned as examples, the data entry system of the invention may be applied to other data entry means (e.g. objects such as user's fingers to which characters, words/part-of-words, etc. may be assigned) and may use other use's behaviors and corresponding recognition systems. For example (as have already been described in previous patent applications filed by this inventor), instead of (or in combination with) analyzing pressing actions on keyboard keys, the system (by for example, using a camera) may recognize the movements of the fingers of the user in the space. For example, a user may tap his right thumb (to which for example, the letter "m, n, o", are assigned) on a table and say "milk". In this example, said user's finger movement combined with said user's speech may be used to enter the word "milk".

In another example and according to same principles, said other data entry means may be a user's handwritten symbol (e.g. graffiti) such as a letter, and said behavior may be user's speech. For example, by using a pen-based device (e.g. PDA, stylus, etc.) using a hand-writing recognition system, a user may write a symbol such as a letter and speak said letter to enhance the accuracy of the recognition system of the system. In another example, said user may write at least one letter corresponding to at least a first phoneme of the speech of a word/part-of-a-word, and speak said word/part-of-a-word. When said user writes said letter, the hand-writing recognition system of the device recognizes said letter and relates it to the words-part-of-the-words and/or phoneme-sets assigned to said at least one letter (or symbol). When the system hears the user's voice, it tries to match it to at least one of said phoneme-sets. If there is a phoneme-set among said phoneme-sets which matches to said speech, then the system selects the character-sets corresponding to said phoneme-set. The rest of the procedure (e.g. the procedure of finding final words) is similar to the ones described in different embodiments of this application and the applications filed before by this inventor.

According to one embodiment, the data entry system of the invention as described in this application and previous applications filed by this inventor, may be summarized as follow:

- A data entry system comprising:
  - The use of at least one object/action (e.g. to which symbols such as at least, a character, a word, a part-of-a-word, a function, etc. may be assigned) for informing the system of at least a first input, combined with;
  - at least one user's behavior (no behavior is also considered as a behavior) for informing the system of at least a second input providing more information to the system for helping the system to select an intended input corresponding to said first input;

wherein, said /action may be objects/actions such as a user's fingers, keys of a keyboard, user's fingerprints, hand-writing, etc., and said user's behavior may be behaviors such as user's speech, directions of user's finger movements (including no movement), user's fingerprints, user's lip or eyes movements, etc.

Contrary to other data entry systems wherein many key presses are used to input few characters, the data entry system of the invention may use few key presses to provide the entry of many characters.

A Method of Configuration of Symbols on a Keypad

Different methods of configuration of symbols have been proposed in prior patent applications filed by this inventor. Fig. 87 shows a method of assignment of symbols to the keys of a keypad 8700.

As before, Letters a-z, and digits 0-9 are positioned on their standard position on a telephone-type keypad and may be inputted by pressing the corresponding key while speaking them.

Also as before, many punctuation characters and functions are assigned to the keys of said keypad and may be inputted by pressing (or double pressing) the corresponding keys without speaking them.

In this configuration, some of the punctuation marks such as "+" sign, which are naturally spoken by the users, are assigned to some keys and may be inputted by pressing a the corresponding key and speaking them.

Also according to this arrangement some symbols such as the "-" sign 8702, which may have different meaning and according to a context, may be pronounced or not pronounced according to the context of the data, are positioned in a key, in two locations. They are once grouped with the symbols requiring speaking while entering them, and also grouped with the symbols who should not be spoken while entering them. To a symbol requiring speech, more than one speech may be assigned according to the context of the data. For example, the sign "-" 8702 assigned to the key 8703, may be inputted in different ways.

- A user may press the key 8703 and say "minus"
- A user may press the key 8703 and say "dash"
- A user may press the key 8703 without speaking.

Thus, while there have been shown and described and pointed out fundamental novel features of the invention as applied to alternative embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the disclosed invention may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto. It is to be understood that the drawings are not necessarily drawn to scale, but that they are merely conceptual in nature. For example, the features described in this application and the applications filed before may apply to all of the embodiments of the invention. Also an embodiment of the invention may be function separately or it may function combined with one or more other embodiments of the invention. Also, for example, if the system comprises enough memory and processing capabilities, a phrase recognition system may be used to select one of said selected word according to the corresponding phrase context.

Interchanging ambiguous symbols on the keys of a keypad

As mentioned before, some symbols such as the letters assigned to a same key of a keypad/keyboard may have nearly similar pronunciations. This may cause ambiguity for the voice/speech recognition system of the invention. Fig. 91a shows a standard telephone-type keypad 9100. Pair of letters, "d" and ""c", assigned to the key 9101 may cause ambiguity to the voice/speech recognition system of the invention when said key is presses and one of said letters is pronounced. Pair of letters, "m" and "n" assigned to the neighboring key 9102 may also cause ambiguity between them when one of them is pronounced. On the other hand, letters "e" or "d" may easily be distinguished from the letters "m" or "n". By interchanging the assignment of one of the letters of each pair to the corresponding key of the other pair, the recognition problem of said four letters (e.g. by using the press and speak data entry system of the invention) will be solved. This may slightly modify the alphabetical order configuration of a keypad, but will dramatically augment the accuracy of the data entry. Fig. 91b shows a keypad 9110 after said modification.

Automatic Spacing Method

As previously mentioned, an automatic spacing procedure for attaching/detaching of portions-of-words/words may be assigned to a mode such as a single-press mode or double-press mode. As already described, a user may enter a symbol such as at least part of a word (e.g. without providing a space character at its end), by speaking said symbol while pressing a key corresponding to the beginning character/phoneme of said symbol (in the character by character data entry system of the invention, said beginning character is said symbol). According to said procedure, also for example, a user may enter a symbol such as at least part of a word (e.g. including a space character at its end), by speaking said symbol while double-pressing said key corresponding to the beginning character/phoneme of said symbol. In data entry systems requiring many key presses to enter a word, this may be particularly beneficial.

According to the above-mentioned principles, for example, in a character-by-character data entry system of the invention, a character may be entered and attached to the previous character, by speaking/not-speaking said character while, for example, single pressing a corresponding key. Same action including a double-pressing action may cause to enter said character and attach it to said previous character, but also may add a space character after the current character. The next character to be entered will be positioned after said space character (e.g. will be attached to said space character). For example, to enter the words "see you ", a user may first enter the letters "s" and "e" by saying them while single pressing their corresponding keys. Then he may say "e" while double pressing its corresponding key. The user then may enter the letters "y" and "o" by saying them while single pressing the corresponding keys. He, then, may say "u" while double pressing the corresponding key.

According to another embodiment of the invention, instead of locating said space character after said current character, the system may locate said space character before said current character.

It is understood that instead of a space character, any other symbol (or group of symbols) may be considered after said character or before it. Of course, considering that a letter is part of a word, as previously described, same procedure applies to part-of-a-word/word level of the data entry system of the invention. Again for example, a user may enter the words "prepare it", he first enter the portion "pre" by saying it while for example, single pressing the key corresponding to the letter "p". Then he may enter "pare" (e.g. including a space at the end of it) by saying "pare " while double pressing the key corresponding to the letter "p". The use then, may enter the word "it " (e.g. also including a space at the end of it) by saying it while double pressing the key corresponding to the letter "i".

QWERTY Configuration on a Keypad Having Reduced Number of Keys

According to one embodiment of the invention, the configuration and/or assignment of letters on a keypad may be according to the configuration of the letters on a QWERTY keyboard. This may attract many people who do not use a telephone-type keypad for data entry simply because they are not familiar with the alphabetical order configuration of letters on a standard telephone keypad. According to one embodiment of the invention, using such keypad combined with the data entry system of the invention may also provide better recognition accuracy by the voice/speech recognition system of the invention.

Fig. 92a shows a telephone-type keypad 920 wherein alphabetical characters are arranged-on/assigned-to its keys according to the configuration of the said letters on a QWERTY keyboard. As shown, the letters on the upper row of the letter keys of a QWERTY keyboard are distributed on the keys 921-923 of the upper row 924 of said keypad 920, in the same order (relating to each other) of said letters on said QWERTY keyboard. The letters positioning on the middle letter row of a QWERTY keyboard are distributed on the keys of the second row 925 of said keypad 921, in the same order (relating to each other) that said letters are arranged on a QWERTY keyboard. And finally, Letters on the lower letter row of a QWERTY keyboard are distributed on the keys of a third row 926 of said keypad 920, in the same order (relating to each other) that they are positioned on a QWERTY keyboard.

With continuous reference to this embodiment, said alphabetical letters may be distributed on the keys of said keypad in a manner to locate ambiguous letters on different keys. Fig. 92b shows as an example, a QWERTY arranged keypad 927 with minor modifications. In said keypad, the key assignment of the letters "M" 928 and "Z" 929, are interchanged in a manner to eliminate the ambiguity between the letters "M" and "N". In this example, the QWERTY configuration has been slightly modified but by using said keypad with the data entry system of the invention, the recognition accuracy may be augmented. It is understood that any other letter arrangement and modifications may be considered.

As shown, the QWERTY keypad of the invention may comprise other symbols such as punctuation characters, numbers, functions, etc. They may be entered by using the data

entry system of the invention as described in this application and the previous applications filed by this inventor.

It must be noted that alphabetical letters having a QWERTY (or any other) arrangement may be assigned to the keys of any keyboard having reduced number of keys. Said keyboard may be combined and used with the data entry system of the invention. It is understood that for better accuracy, any standard arrangement may be modified.

QWERTY Arrangement on Six Keys

According to one embodiment of the invention, the data entry system of the invention may use a keyboard/keypad wherein alphabetical letters having a QWERTY arrangement are assigned to six keys of said keyboard/keypad.

As known, alphabetical letters are arranged on the keys of three rows of keys a PC keyboard according to a configuration order called QWERTY. Fig 93 shows a QWERTY keyboard 9300 wherein the letters A to Z are arranged on three rows of the keys 9307, 9308, 9309 of said keyboard. Usually, a user uses the fingers of his both hand for (touch) typing on said keyboard. By using the fingers of his left hand, a user for example, types the alphabetical keys as shown on the left side 9301 of said keyboard 9300, and by using the fingers of his right hand, a user for example, types the alphabetical keys situated on the right side 9302 of said keyboard 9300. According to these principles, it may be considered that the alphabetical keys of a QWERTY keyboard are arranged according to a three-row 9307, 9308, 9309 by two-column 9301-9302 table.

According to one embodiment of the invention, a group of six keys (e.g. 3 by 2) of a reduced keyboard may be used to duplicate said QWERTY arrangement of a PC keyboard on them and used with the data entry system of the invention. Fig. 93a shows as an example, six keys preferably arranged in three rows 9317-9319 and two columns 9311-9312 for duplicating said QWERTY arrangement on them. As an example, the upper left key 9313 contains the letters "QWERT", corresponding to the letters situated on the keys of the left side 9301 of the upper row 9301 of the QWERTY keyboard 9300 of the Fig. 93. The Other keys of said group of six keys follow the same principle and contain the corresponding letters situated on the keys of the corresponding row-and-side of said PC keyboard.

A user of a QWERTY keyboard usually knows exactly the location of each letter. A motor reflex permits him to type quickly on a QWERTY keyboard. Duplicating a QWERTY arrangement on six keys as described here-above, permits the user to touch-type (fast typing) on a keyboard having reduced number of keys. Said user may, for example, use the thumbs of both hands (left thumb for left column, right thumb for right column) for data entry. This looks like keying on a PC keyboard permitting fast data entry.

It is understood that the left side and right side characters definition of a keyboard described in the example above is shown only as an example. Said definition may be

reconsidered according to user's habitudes. For example, the letter "G" may be considered as belonging to the right side rather than left side.

According to one embodiment of the invention, a keypad having at least six keys containing alphabetical letters with QWERTY arrangement assigned (as described above) to said keys, may be used with the character-by-character data entry system of the invention. In addition to already-described advantages, said arrangement also comprises other benefits such as:

- letters situated on a same key are usually distinguishable by the voice/speech recognition system of the invention
- high accuracy of the data entry, extremely reduced number of letter keys, and the extremely familiar arrangement (e.g. QWERTY) of said letters on said keypad permit a user a fast data entry system without the need of frequently looking at the keypad or at the display unit of the corresponding device.

For better accuracy, minor modification to this arrangement may be considered. For example, Fig. 93b, shows a keypad 9320 having at least six keys with QWERTY letter arrangement as described before, wherein letters "Z" 9321 and "M" 9322 have been interchanged in order to separate the letter "M" from the letter "N" 9323. It is understood that this is only an example, and that other forms of modifications may also be considered.

It must be noted that the QWERTY arrangement assigned to few number of keys as described above, is shown and described only as an example. Other configurations of alphabetical letters (in any language) may be assigned to any number of keys arranged in any key arrangement form on a any shape of keyboard (e.g. any keypad) and used with the press and speak data entry system of the invention. Also, it is understood that other symbols such as punctuation marks, numbers, functions, etc., may be distributed among said keys or other keys of a keypad comprising said alphabetical keys and be entered according to the data entry system of the invention as described in this application and the applications filed before by this inventor.

According to one embodiment of the invention, still fewer number of keys may be used to contain alphabetical letters (and other symbols as described before) and being used with the press and speak data entry system of the invention. Fig. 93c shows as an example, four keys 9330, 9333 having English alphabetical characters assigned to them. To keep this arrangement familiar, the QWERTY arrangement of the letters of the top two rows of the keypad 9320 of the Fig. 93b are maintained and the letters of the lowest row of said keypad 9320 of the fig. 93b are distributed within the keys of the corresponding columns (e.g. left, right) of said four keys 9330, 9333 in a manner to maintain the familiarity of an "almost QWERTY" keyboard along with high accuracy of the voice recognition system of the invention. For example, letters "n" 9337 and "m" 9338 which have been located on the lowest right key of the keypad 9320 of the fig. 93b, are here separated and assigned, respectively, to the right keys 9333 and 9332 of the keypad 9330. It is understood that other symbols such as punctuation marks, numbers, functions, etc., may be distributed among said keys or other keys of a keypad comprising

said alphabetical keys and be entered according to the data entry system of the invention as described in this application and the applications filed before by this inventor.

It is also understood that as far as the recognition accuracy is not affected, even fewer keys may be used to contain all alphabetical characters and be used with the press and speak data entry system of the invention. Fig. 93d shows two keys 9341-9342 (of a keypad) to which the English Alphabetical letters are assigned. Said keypad may be used with the press and speak data entry system of the invention but ambiguity may arise for letters on a same key having closed pronunciation.

Theoretically, all of the alphabetical letters may be assigned to a single key but this may extremely reduce the recognition accuracy.

Although, pressing a key and speaking a desired symbol assigned to said key may be enough for the entry of said symbol, for some reasons such as not desiring to speak some symbols, several methods such as the ones described in this application and in the previous applications concerning the data entry system of the invention may be provided. As described, a symbol may be entered by pressing a key without speaking said symbol. For example, by referring to the fig. 93c, a user may press the key 9330 without speaking to provide the space character. According to another method, a symbol may be entered by pressing a first key, keeping said key pressed and pressing a second key, simultaneously. According to another method, a special character such as a space character may be provided after a symbol such as a letter, by pressing a predefined key (e.g. corresponding to said special character) before releasing the key corresponding to said symbol.

When having few keys for data entry, for faster data entry, the entry of a frequently used non-spoken symbol such as a space character may be assigned to a double press action of a predefined key without speaking. This may be efficient, because if the space character is assigned to a mode such as a single-pressing a button to which other spoken characters such as letters are assigned in said mode, after entering a spoken character, (for not confusing the voice/speech recognition system) the user has to pause a short time before pressing the key (while not speaking) for entering said space character. Assigning the space character to the double-press mode of a key, to which no spoken symbol is assigned to a double-press action, resolves that problem. Instead of pausing and pressing said key once, the user simply double-presses said key without said pause.

Also, it is understood that the QWERTY arrangement of the letters on a group of keys as described here-above, is provided as an example. Other configuration of symbols such as the alphabetical orders, on other number of keys, in any key arrangements, may be considered. For example, according one embodiment of the invention, a keypad may contain two keys for assigning the most frequently used letters, and it may have other two keys to which less frequently used letters are assigned.

Today most electronic devices permitting data entry are equipped with a telephone-type keypad. The configuration and assignment of the alphabetical letters as described before may be applied to the keys of a telephone-type keypad.

Fig. 94a shows a telephone-type keypad 9400 wherein alphabetical letters having QWERTY configuration are assigned (e.g. as described before) to six keys of two neighboring columns 9401, 9402 of said keypad. By being on neighboring columns, entry of the letters by (the thumb of) a single hand becomes easier. Also as mentioned before, the user may use his both thumbs (e.g. left thumb for left column, right thumb for right column) for quick data entry. It is understood that other symbols such as punctuation marks, numbers, functions, etc., may be distributed among the keys of said keypad and be entered according to the data entry system of the invention as described in this application and the applications filed before by this inventor.

Fig. 94b shows another telephone-type keypad 9410 wherein alphabetical letters having QWERTY configuration are assigned (e.g. as described before) to six keys of two exterior columns 9411, 9412 of said keypad. By being on two exterior columns, entry of the letters by (the thumbs of) two hands becomes easier. Also as mentioned before, the user may a single hand for data entry. In this example, minor modifications have been applied for augmenting the accuracy of the voice/speech recognition system of the invention. For example, letters "m" and "k" have been interchanged on the corresponding keys 9413, 9414 to avoid the ambiguity between the letters "m" and "n". Also, letters "f" and "z" have been interchanged on the corresponding keys 9413, 9414 to avoid the ambiguity between the letters "f" and "s". It is understood that other changes in the configuration may be considered. For faster data entry some characters such as the space character may be assigned to several keys 9415, 9416.

Fig. 94c shows another telephone-type keypad 9420 wherein alphabetical letters arrangement based on principles described before and showed in fig. 93c are assigned to four keys of said keypad.

It is understood that the QWERTY arrangement of letters on few (e.g. 6, 4, 2. etc.) keys of a keyboard such as a keypad is described as example. Other kind of letter arrangements such as alphabetical order may also be considered and assigned to few keys such as two/four/six. etc., keys.

A personal mobile computer/telecommunication device

A mobile device must be small to provide easy portability. An ideal mobile device requiring data (e.g. text) entry and/or data communication must have small data entry unit (e.g. at most, only few keys) and a large (e.g. wide) display.

The arrangement of alphabetical letters (and other symbols) on few keys and the capability of quick and accurate complete data entry provided by the data entry system of the invention through said few keys, may permit to reconsider the design of some of the current products for making them more efficient.

One of those products is the mobile phone which is now used for the tasks such as text messaging and the internet, and is predicted to become a mobile computing device. The actual mobile phone is designed contrary to the principles described here-above. This is

because the (complicated) data entry systems of the mobile phones require the use of many keys, using a substantial surface of the phone, providing slow data entry, and leaving a small area for a small (e.g. narrow) display unit.

One of the most commonly used applications of a computer is the word processing procedure. Along with the use of the Internet, writing letters will also become the most commonly used application of a mobile computer/communication device. Said application requires a wide display to permit drafting, formatting, and viewing the document preferably in its entire width. For example, while drafting a letter, the user must see said document in its entire width, without being obliged to scroll it to the left or to the right.

According to one embodiment of the invention, an electronic device such as a mobile computing/communication device comprising a wide display and small data entry unit having quick data entry capability may be provided. Fig. 95a shows a mobile computing/communication device 9500 having two rows of keys 9501, 9502 wherein the alphabetical letters (e.g. preferably, having QWERTY arrangement as described before) are assigned to them. Other symbols such as numbers, punctuation marks, functions, etc. may also be assigned to said keys (or other keys), as described before. Said keys of said communication device may be combined with the press and speak data entry system of the invention to provide a complete quick data entry. Use of few keys (e.g. in two rows only) for data entry, permits to integrate a wide display 9503 within said device. The width of said mobile device (and obviously, said display unit) may be approximately the width of an A4 paper to provide an almost real size (e.g. width) document for viewing. Said mobile computing/communication device may also have other buttons such as the buttons 9504, 9505 for functions such as scrolling the document to upward/downward, to left/right, navigating a cursor 9506 within said display 9503, send/end functions, etc. Also said device may comprise a mouse (e.g. a point and click device) within, for example, the backside of it. In several patent applications (such as "stylus Computer", and "Features to Enhance Data Entry") filed by this inventor mouse/browsing issues on a display and other data entry enhancement means have been described. All of said issues of said applications may be combined between them and/or combined with the data entry system and data communication devices of this invention.

With continuous description of Fig. 95a, the arrangement of the keys in two rows 9501, 9502 on left and right side of said communication device 9500 permits the user to thumb-type with his two hands while holding said device 9500. It is understood that other configuration of letters and other symbols on other arrangement of keys on said device may be considered. For example, the device may comprise only few keys arranged in only one row wherein said symbols (e.g. letters) are assigned to them.

Also as mentioned before and described in corresponding patent application, by providing a mouse (not shown) in the backside of said device, the user may use for example, his forefinger, for operating said mouse while pressing a relating button with his thumb.

Also, as mentioned, said device may be used as a telephone. It may comprise at least one microphone 9507 and at least a speaker 9508. The distance between the location of said microphone and said speaker on said device may correspond to the distance between mouth and ear of a user.

Fig. 95b shows as an example, a device 9510 similar to that of the fig. 9500, wherein its input unit comprises four keys only, arranged in two rows 9511, 9512 and wherein the alphabetical letters and numbers are assigned to said keys according to principles already described. Other symbols and functions (not shown) may also be assigned to said keys and/or other keys according to the principles already described. A user may use his two thumbs 9513, 9514 for typing.

Fig. 95c shows as an example, a device 9520 similar to that of the fig. 9510, wherein its input unit comprises four keys only arranged in two rows 9521, 9522 located on one side of said electronic device, and wherein the alphabetical letters, and numbers are assigned to said keys according to principles already described. Other symbols and functions (not shown) may also be assigned to said keys and/or other keys according to the principles already described. A user may use one hand (or two hands) for data entry. A nub 9523 may be provided in the center of arrangement of said four keys to permit data entry without looking at the keypad.

Fig. 95d shows as an example, a device 9530 similar to that of the fig. 9520, wherein its input unit comprises four keys arranged in two rows 9531, 9532 located on one side of said electronic device, and wherein the alphabetical letters, and numbers are assigned to said keys according to principles already described. A third row of keys 9533 duplicating one of said first two rows of keys (in this example, 9531), is positioned at the opposite end of said electronic device 9530. This arrangement of keys permits the user to enter data with one or two hands at his choice. Other symbols and functions (not shown) may also be assigned to said keys and/or other keys according to the principles already described.

Fig. 95e shows as an example, an electronic device 9540 designed according to the principles described in this application and similar to the preceding embodiments with the difference that here an extendable/retractable/foldable display 9541 may be provided within said electronic device to permit a large display while needed. For example, by using an organic light-emitting diode (OLED) display, said electronic device may be equipped with a one-piece extendable display.

According to one embodiment of the invention, as shown in fig. 95f, an electronic device 9550 such as the one described before, may comprise a printing unit (not shown) integrated within it. Because of the design of said electronic device (e.g. having approximately the width of an A4 paper) a printing/scanning/copying unit may be integrated within said device. for example, a user may feed a paper 9551 to print a page.

Providing a complete solution for a mobile computing/ communication device may be extremely useful in many situations. For example, a user may draft documents such as a

letter and print them immediately. Also for example. a salesman may draft a document such as an invoice in client's promises and print it for immediate delivery.

To permit reducing the size of said mobile computing/ communication device and still being capable of printing a standard size paper such as an A4 paper, a device corresponding to the size of half of said standard size paper may be provided.

Fig. 95g shows a standard blank document 9560 such as an A4 paper. As shown in Fig. 95h, said paper may be folded in its middle, providing two half faces 9561, 9562. As shown in Fig. 95k said folded document may be fed into the printing unit of an electronic device 9570 such as the mobile computing/communication device of the invention to print a page of a document such as an edited letter, on its both half faces 9561, 9562 providing a standard sized printed letter. This will permit manufacturing of a small sized mobile electronic device being capable of printing a standard size document.

Circular Keyboard

According to one embodiment of the invention, at least part of the keys of a keypad may be positioned on said keypad in a manner to create a circular form. Fig 96 shows as an example, a keypad 9620 comprising six keys 9621-9626 positioned around a centered key 9627. Said centered key 9627 may be physically different than said other six keys. For example, said key 9627 may be bigger than the other keys, or it may be have a nub on it. Alphabetical letters having QWERTY configuration may be distributed among said keys. A space character may be assigned to the key 9627 situated in the center. Of course said keys may also comprise other symbols such as numbers, punctuation marks, functions, etc as described earlier in this application and the applications before. The advantage of this kind (e.g. circular) of key arrangement on a keypad is that, by recognizing said centered. key by touching it, a user may type on said keys without looking at the keypad.

A Wrist Communication Device

The data entry system of the invention may permit to create small electronic devices with capability of complete. quick data entry. One of the promising future telecommunication devices is a wrist communication device. Many efforts have been provided to create a workable wrist communication/organizer device. The major problem of such device is workable relatively quick data entry system. Some manufacturers have provided prototypes of wrist phones using voice/speech recognition technology for data entry. Of course, hardware and software limitation of such devices provide poor data entry results. The data entry system of the invention combined with use of few keys as described in this application and the applications filed before by this inventor may resolve this problem and permit quick data entry on very small devices. Fig. 96a shows as an example, a wrist electronic device 9600 comprising few keys (e.g. in this example, four keys arranged in two rows 9601, 9602) wherein symbols such as alphabetical letters, numbers, punctuation marks, etc., are assigned to said keys according to the principles of the data entry system of this invention. Said electronic device also comprises a data entry system of the invention using at least said keys. Said keys may be of any kind such as resembling to the regular keys of a mobile phone, or being touch-sensitive. Touch sensitive keys may

permit touch-typing with two fingers 9603, 9604 of one hand. A display unit 9505 may also be provided for viewing the data entered, the data received, etc. A watch unit 9606 may also be assembled with said wrist device. Said wrist device may also comprise other buttons such as 9607, 9608 for functions such as send/end, etc.. It must be noted that for faster data entry, a user my remove the wrist device from his wrist and use the thumbs of both fingers, each for pressing the keys of one row of keys.

it is understood that other number of keys (e.g. 6 keys as described before) and other key arrangements (e.g. such as the circular key arrangement described before) may be considered.

It is also understood that other kinds of designs for a wrist communication/organizer device may be considered. For example, as shown in Fig. 97a, a flip cover portion 9701 may be provided with a wrist device 9700. Said device 9700 may for example, comprises most of the keys 9703 used for data entry, and said flip cover 9701 may comprise a display unit 9702 (or vise versa). As shown in Fig. 97b, on the other side of said flip cover, a display unit 9711of a watch unit may be installed. In closed position, said wrist device may resemble, and be used as, a wristwatch.

It is understood that the wrist devices shown and described here above are shown only as examples. Other types of wrist devices may be considered with the press and speak data entry system of the invention requiring the use of only few keys. For example, as shown in fig. 98a, a wrist communication device 9800 comprising the data entry system of the invention using few numbers of keys 9803, may be detachabely-attached-to/integrated-with the bracelet 9801 of a watch unit 9802. Fig. 98b shows a wrist device 9810 similar to the one 9800 of the fig. 98a with the difference that here the display unit 9811 and the data entry keys 9812 are separated and located on a flip cover 9813 and the device main body 9814, respectively (or vise versa).

As mentioned, the data entry system of the invention may be integrated within devices having few numbers of keys. A PDA is an electronic organizer that usually uses a handwriting recognition system or miniaturized virtual QWERTY keyboard wherein both methods have major shortcoming providing slow and frustrating data entry procedure.. Usually most PDA devices contain at least four keys. The data entry system of the invention may use said keys according to principles described before, to provide a quick and accurate data entry for PDA devices. Other devices such as Tablet PCs may also use data entry system of the invention.

Movement-Tracking for Data Entry

Dividing a group of symbols such as alphabetical letters, numbers, punctuation marks, functions, etc., in few sub-groups and using them with the press and speak system of the invention may permit the elimination of use of button pressing action by, eventually, replacing it with other user's behavior recognition systems such as recognizing his movements. Said movements may be the movements of for example, fingers, eyes, face, etc., of a user. This may be greatly beneficial for user's having limited motor ability, or in environments requiring more discrete data entry system.

According to one embodiment of the invention, and by referring to fig. 93c as an example, a user may move his eyes (or his face, in case of face tracking system, or his fingers in case of finger tracking system) to the upper right side and say "Y" for entering said letter. Same movement without speaking may be assigned to for example, the punctuation mark "." 9335. To enter the letter "s", the user may move his eyes towards lower left side and say "S". By using only few clearly/easily recognizing movements of a user assigned to few sub-group of symbols combined a feature (of the data entry system of the invention) such as speaking a desired symbol, the data entry system of the invention will provide quick and accurate data entry without requiring hardware (e.g. buttons).

It is understood that as described in previous applications instead of keys other objects such as a sensitive keypad or user's fingers may be used for assigning said subgroups of symbols to them. For example, for entering a desired symbol, a user may tap his finger (to which said symbol is assigned) on a desk and speak said letter assigned to said finger (movement). Also instead of voice/speech of the user other user's behavior and behavior recognition systems such as lip reading systems may be used.

One of the major problems for the at-least-part-of-a-word level (e.g. syllable-level) data entry of the invention is that if there is an outside noise and the speech of said part-of-the-word ends with a vowel, the system may misrecognize said speech and provide an output usually corresponding to the beginning of the desired portion but ending with a constant. for example, if a user says "mo" (while pressing the key corresponding to the letter "m"), the system may provide an output such as "mall". To eliminate this problem some methods may be applied with the data entry system of the invention,

According to one embodiment of the invention, as proposed in previously, word/portion-of-a-word ending with a vowel pronunciation may be grouped with the portions having similar beginning pronunciation but ending with a consonant. After said portions are entered, the dictionary comparison and phrase structure will decided what was is desired portion to be inputted.

According to one embodiment of the invention, a keypad wherein the alphabetical letters are arranged on for example, two columns of keys may be used for the at-least-part-of-a-word level (e.g. syllable-level) data entry system of the invention.

Fig. 99 shows as an example, a keypad 9900 wherein the alphabetical letters are arranged on two columns of keys 9901 and 9902. Said arrangement locates letters/phonemes having closed pronunciation on different keys. Said arrangement also reminds a QWERTY arrangement with some modifications. In this example, the middle column does not contain letter characters. Different methods of at-least-part-of-a-word level (e.g. syllable-level) data entry system of the invention as described earlier may use said type of keypad or other keypads such as those shown in previous figs. having few keys, such the figs. 93a to 93d.

As described earlier, according to one embodiment of the invention, if a word/portion-of-a-word ends with a vowel, a user may press a key of said keypad corresponding to the beginning phoneme/letter of said word/portion-of-a-word and speak said word/part-of-a-word, for entering it. If necessary, for providing more information about said portion, a user may press additional keys corresponding to at least part of the letters constituting said portion. For example, if said word/part-of-a-word ends with a consonant phoneme, the user may press an additional key corresponding to said consonant.

To permit the system to distinguish between a key press corresponding to the beginning phoneme of a word/portion-of-a-word and a key press corresponding to for example. the last phoneme of said word/portion-of-a-word, different methods such as the ones described hereafter, may be provided.

According to one embodiment of the invention, when a user presses a first key corresponding to the beginning phoneme/letter of a word/portion-of-a-word while speaking it, he may keep said key pressed, and press at least an additional key corresponding to another letter (preferably the last consonant) of said word/portion-of-a-word.

If said another letter is located on a same beginning key, the user may double-press said key while speaking said word/part-of-a-word.

Fig. 99a shows a keypad 9910 wherein alphabetical characters (shown in uppercase) are arranged on two columns of its keys 9911, 9912. Each of said keys containing said alphabetical characters also contains the alphabetical characters (shown in lowercase) assigned to the opposite key of the same row. When a user attempts to enter a word/part-of-a-word, he presses the key corresponding to the beginning character/phoneme of said word/part-of-a-word printed in uppercase letter and speaks said word/part-of-a-word. If said user desires to provide more information such as pressing a key corresponding to an additional letter of said word/part-of-a-word, (while keeping said first key presses) said user may press a key situated on the opposite column corresponding to said additional letter (printed in uppercase or lowercase on a key of said opposite column) of said word/part-of-a-word. For example, if a user desires to enter the word "fund", he first presses the key 9913 and says said word, and (while keeping said key 9913, pressed) said user presses consecutively, for example. two additional keys 9914 and 9915 corresponding to the consonants "n", and "d".

Fig. 99b shows a keypad 9920 similar to the keypad of the fig. 99b with the difference that, here two columns 9921, 9922 are assigned to the letters/phonemes corresponding to a beginning phoneme of a word/part-of-a-word, and an additional column 9923 is used to provide more information about said word/part-of-a-word by pressing at least a key corresponding to at least a letter other than the beginning letter of said word/part-of-a-word. This may permit data entry using one hand only. For example, if a user desires to enter the word "fund", he first presses the key 9924 and says said word, and (after releasing said key 9924) said user presses consecutively, for example, two additional keys 9925 and 9926 corresponding to the consonants "n", and "d".

Thus, while there have been shown and described and pointed out fundamental novel features of the invention as applied to alternative embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the disclosed invention may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto. It is to be understood that the drawings are not necessarily drawn to scale, but that they are merely conceptual in nature. For example, the features described in this application and the applications filed before may apply to all of the embodiments of the invention. Also an embodiment of the invention may be function separately or it may function combined with one or more other embodiments of the invention. Also, for example, if the system comprises enough memory and processing capabilities, a phrase recognition system may be used to select one of said selected word according to the corresponding phrase context.

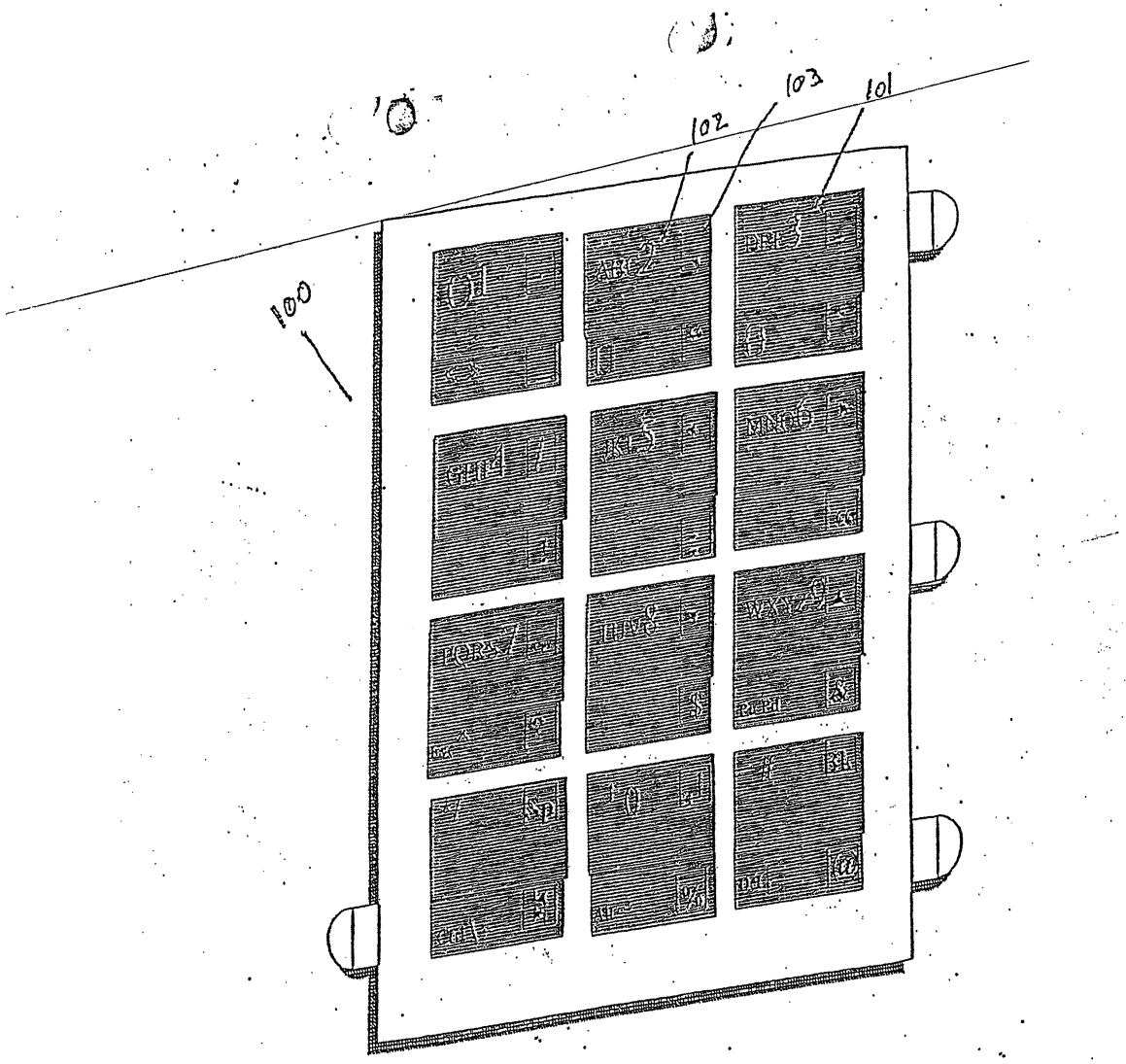

Fig 1

1/55

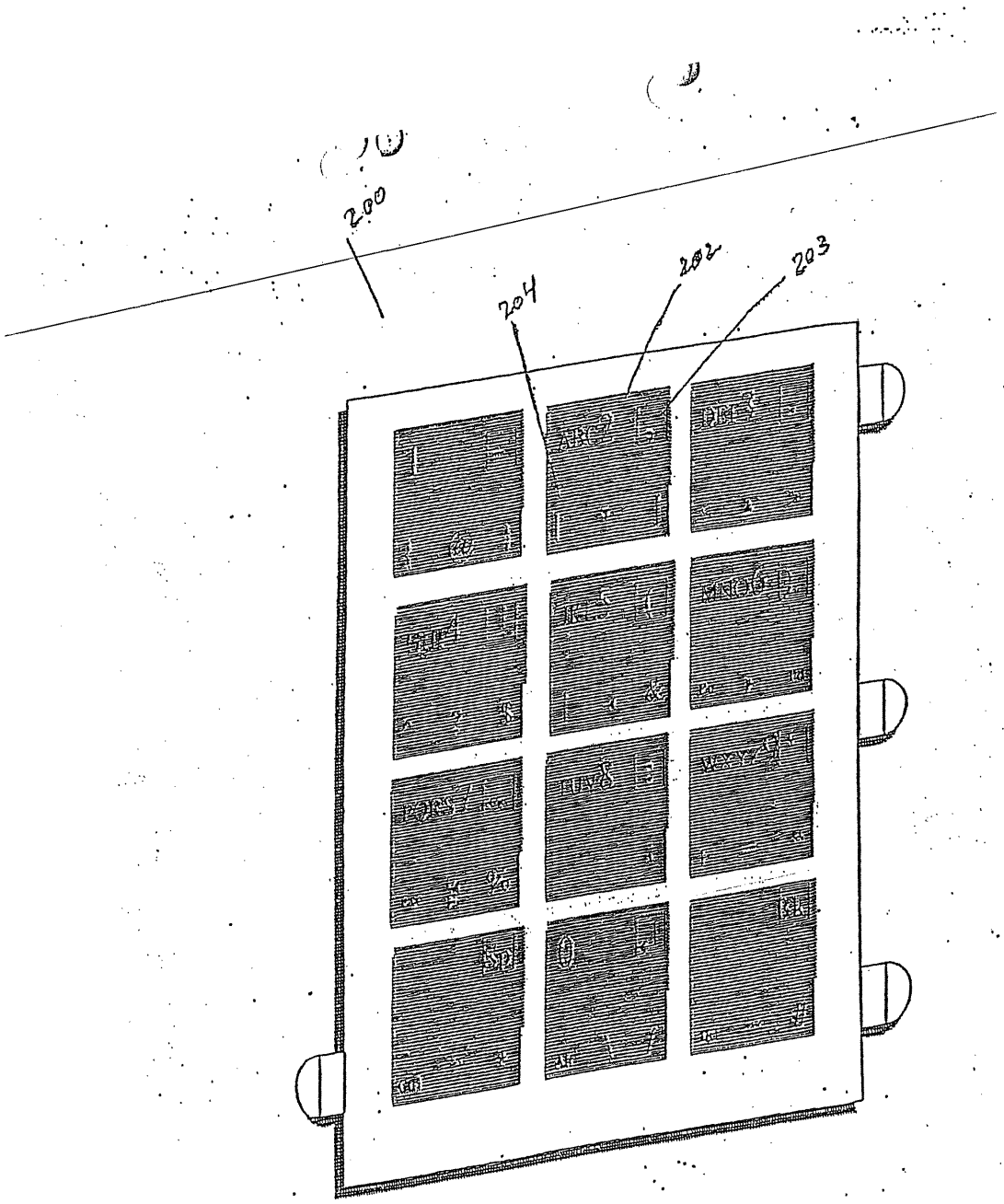

Fig 2 2/55

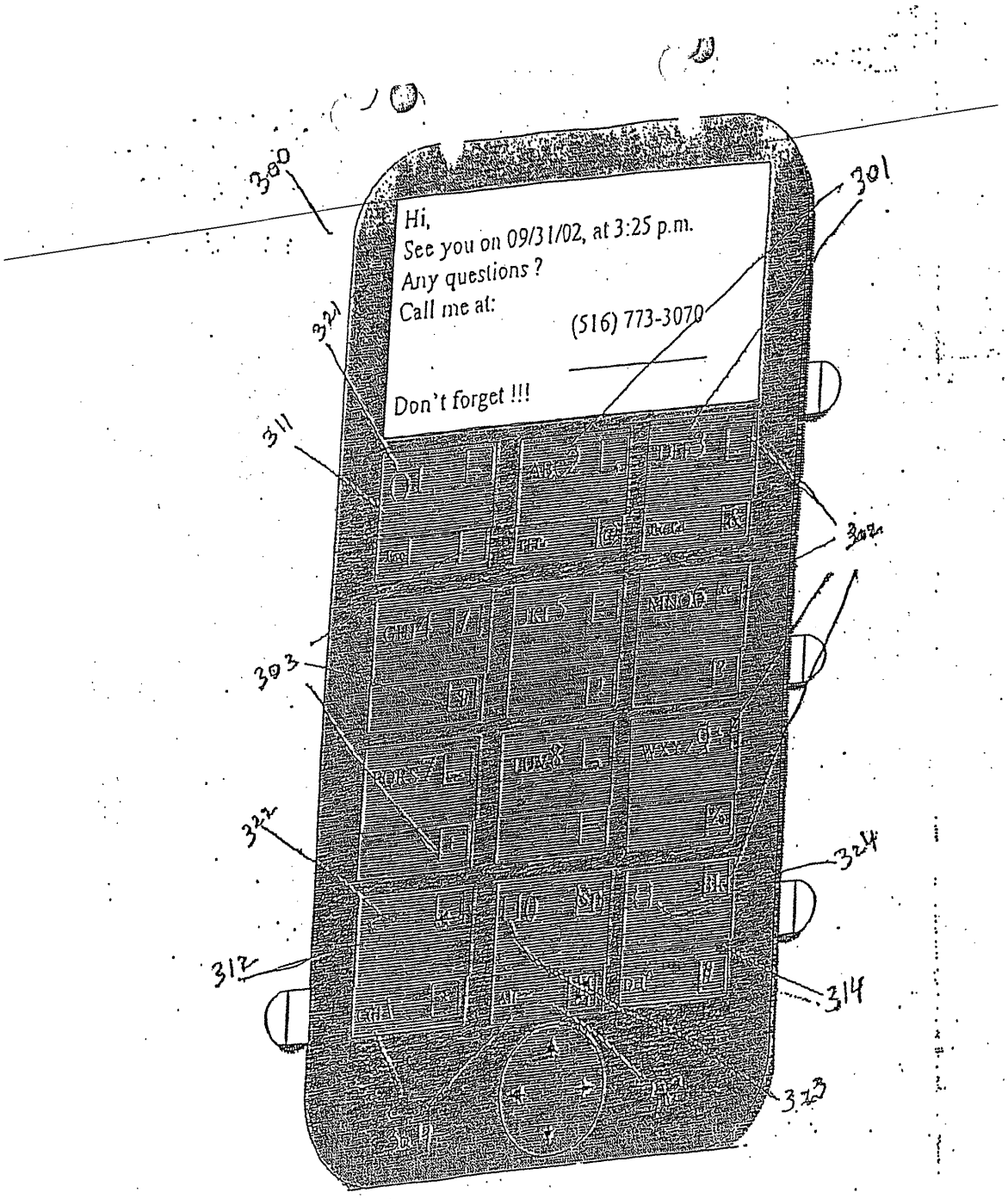
300
301
Hi,
See you on 09/31/02, at 3:25 p.m.
Any questions ?
Call me at:
(516) 773-3070
Don't forget !!!
321
311
302
303
322
324
312
314
323

Fig 3-

3/55

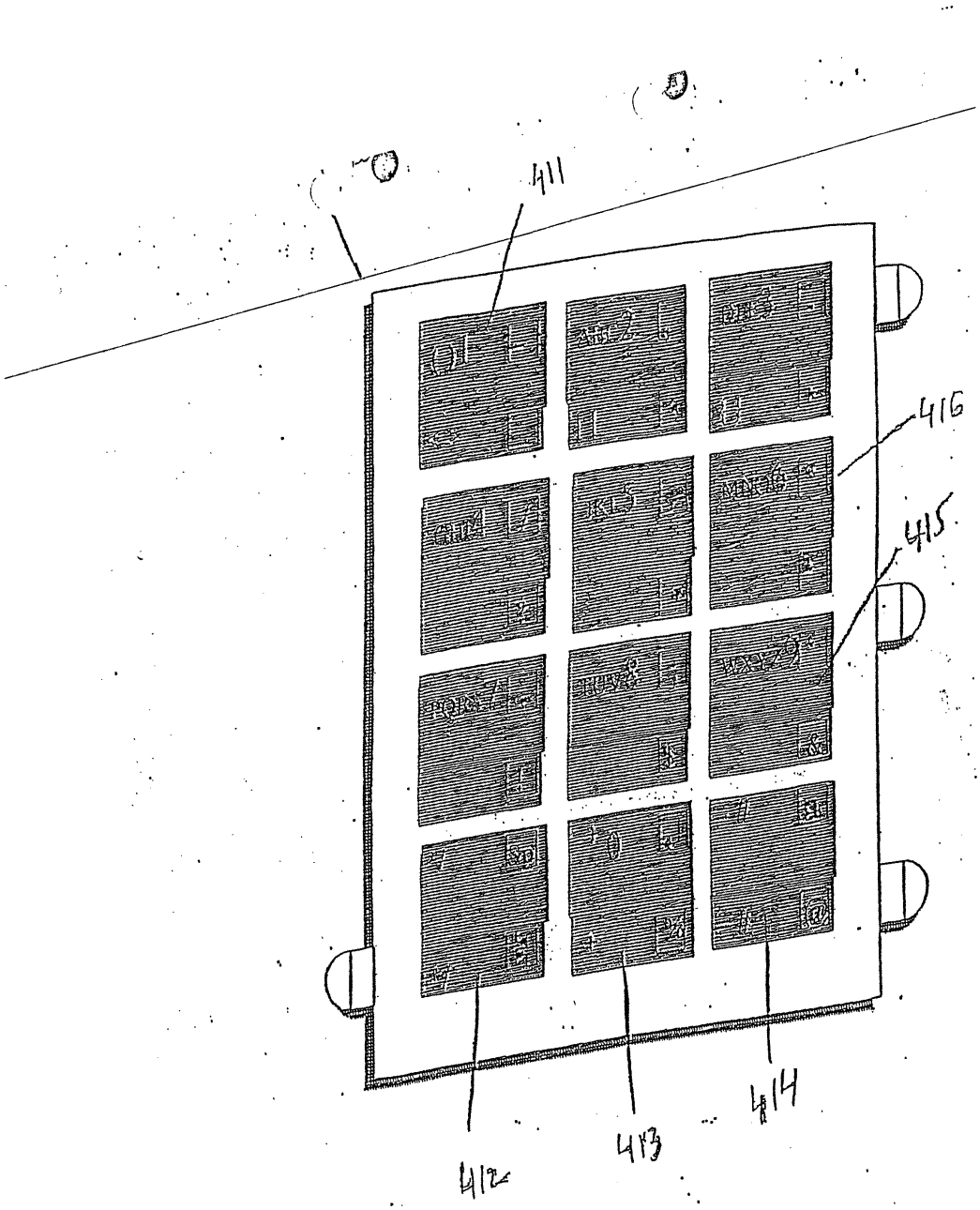

Fig 4 4/55

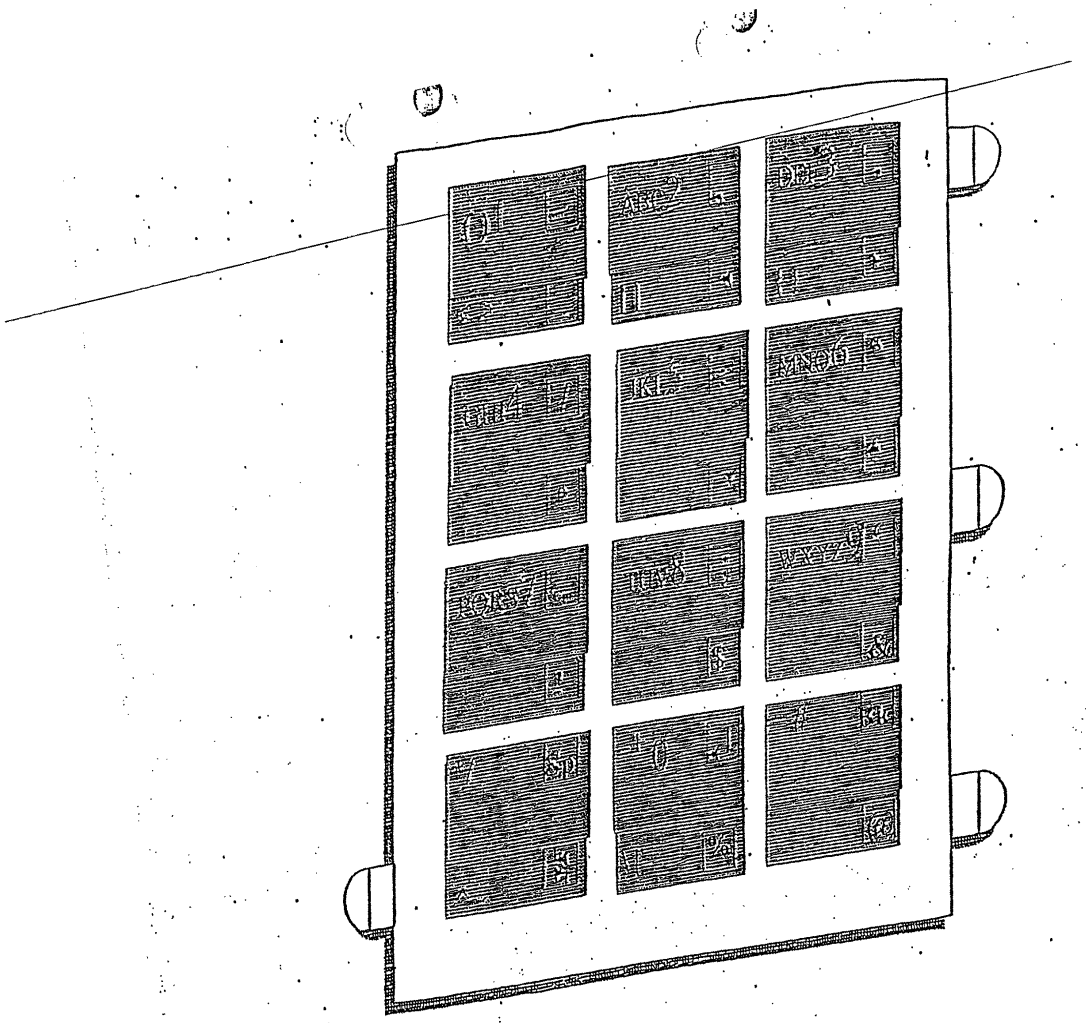

Fig 5

5/55

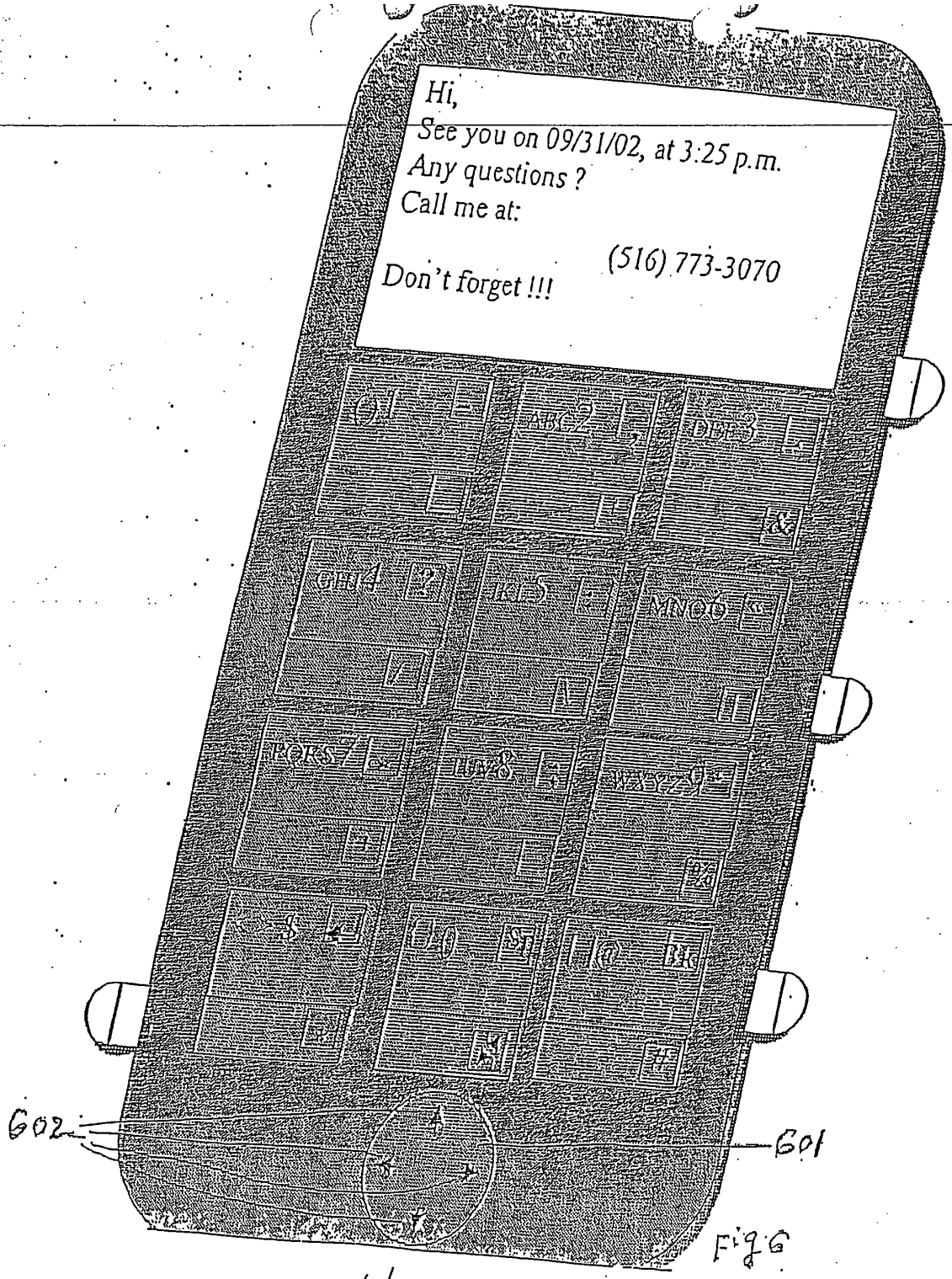
Hi,
See you on 09/31/02, at 3:25 p.m.
Any questions ?
Call me at:
(516) 773-3070
Don't forget !!!
601
602

Fig 6

6/55

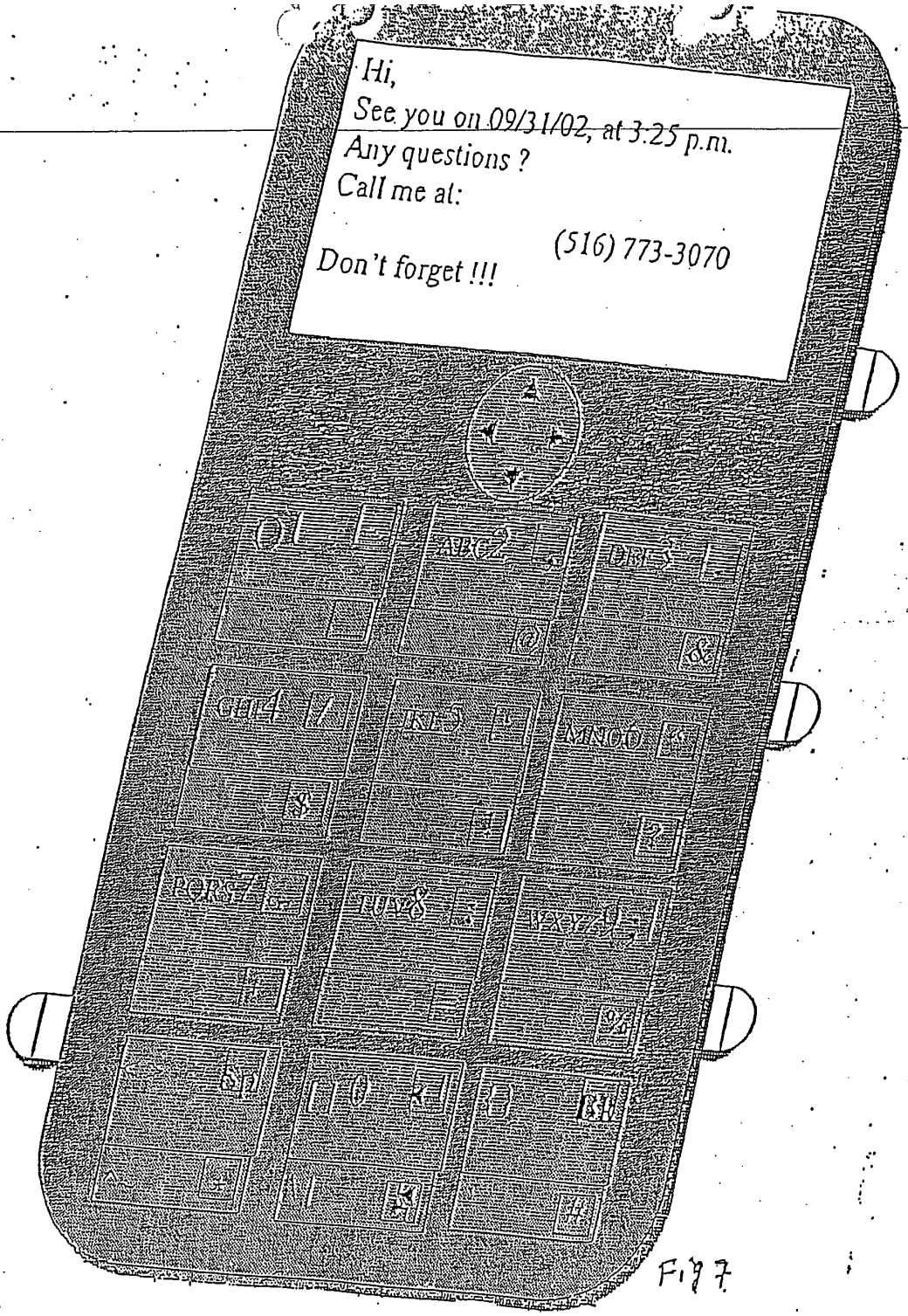
Hi,
See you on 09/31/02, at 3:25 p.m.
Any questions ?
Call me at:
(516) 773-3070
Don't forget !!!

Fig 7

7/55

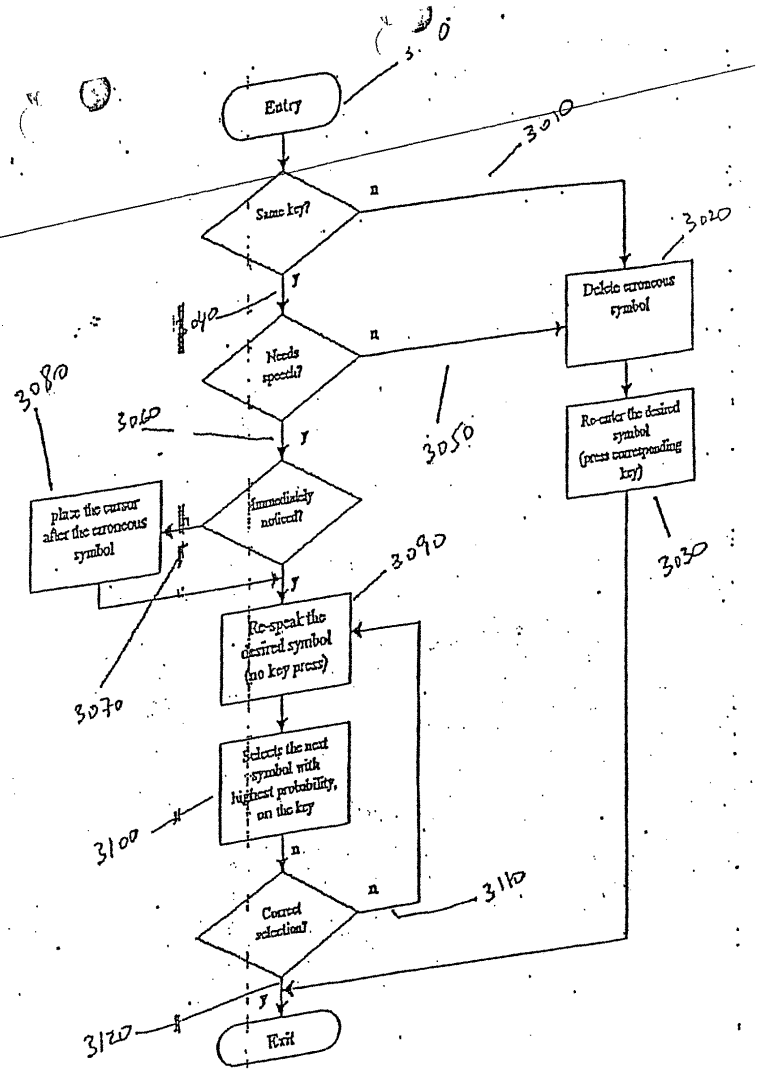
Entry
Same key?
n
y
Needs speed?
n
y
Delete erroneous symbol
Re-enter the desired symbol (press corresponding key)
Immediately noticed?
n
y
place the cursor after the erroneous symbol
Re-speak the desired symbol (no key press)
Selects the next symbol with highest probability, on the key
n
Correct selection?
n
y
Exit

Fig 7B

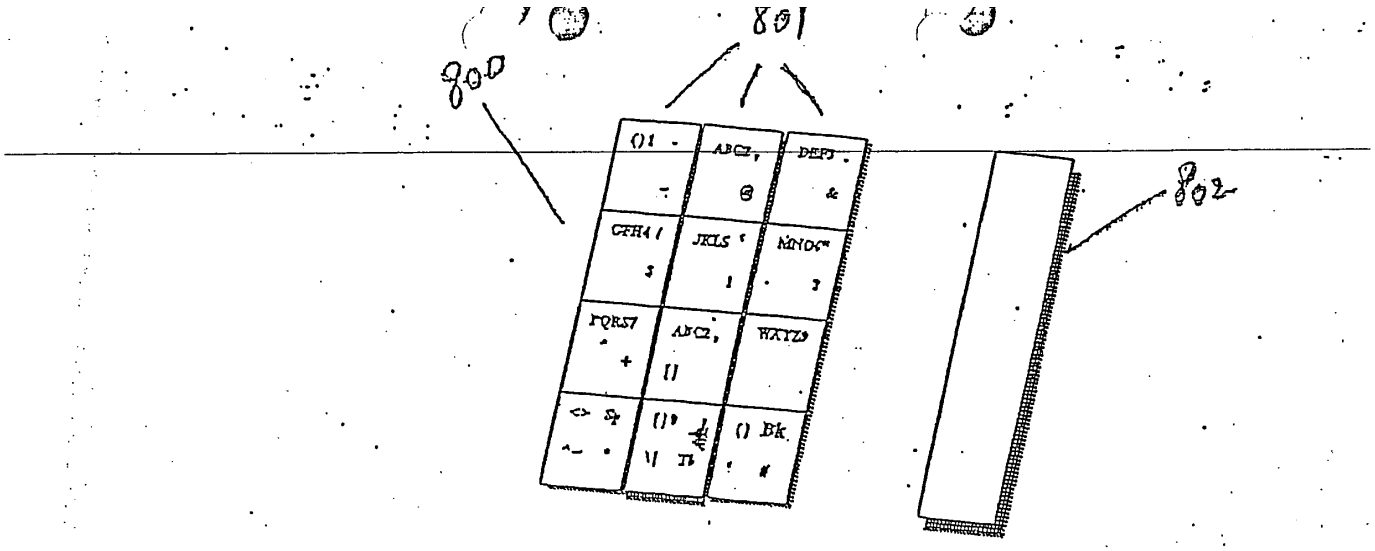

Fig 8

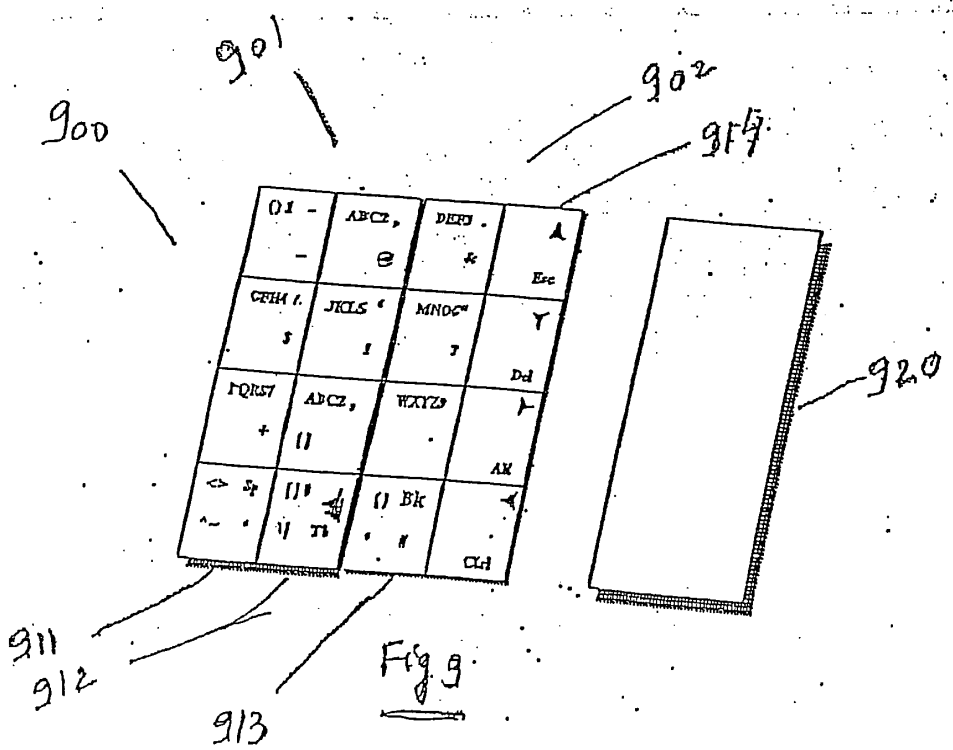

Fig 9

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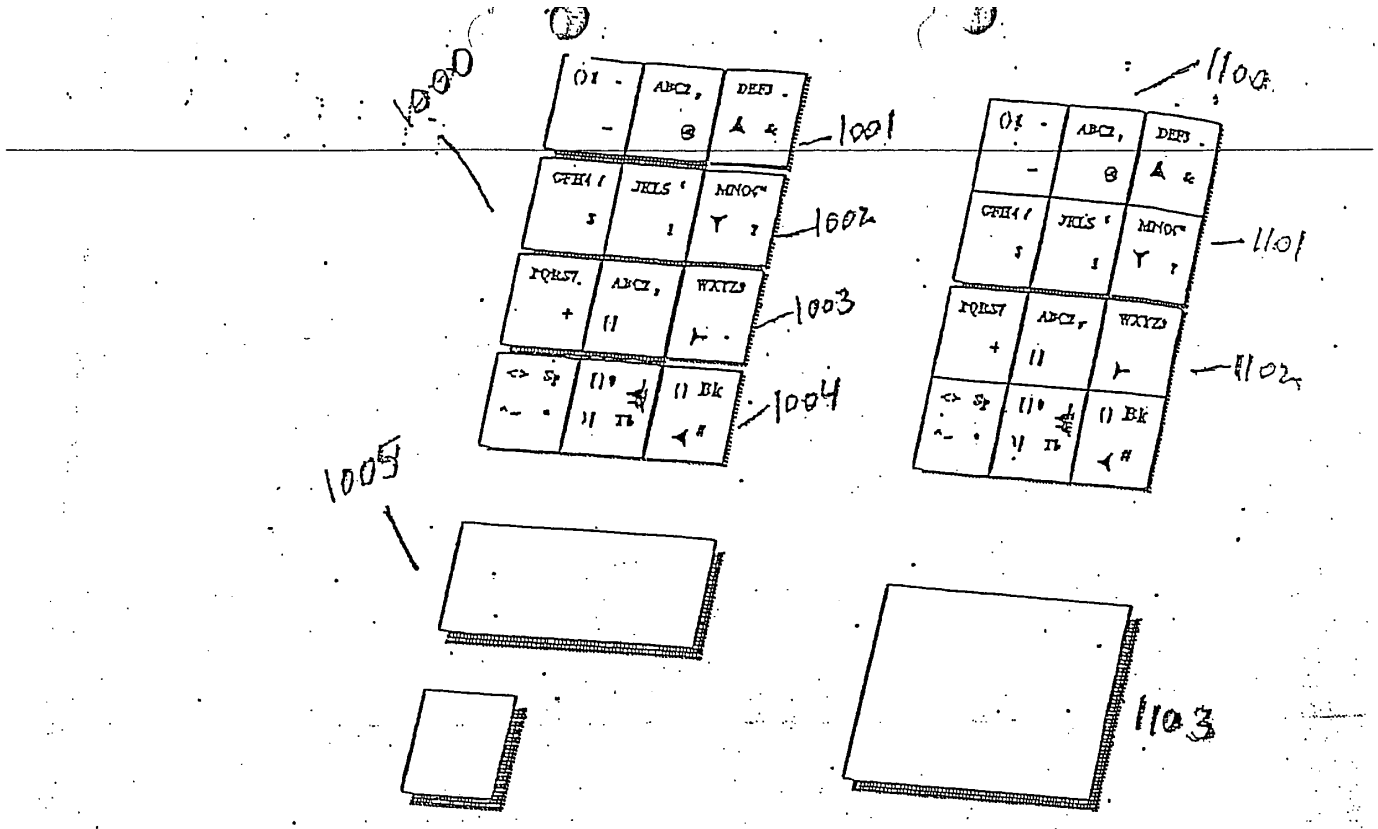


Fig 10

Fig 11

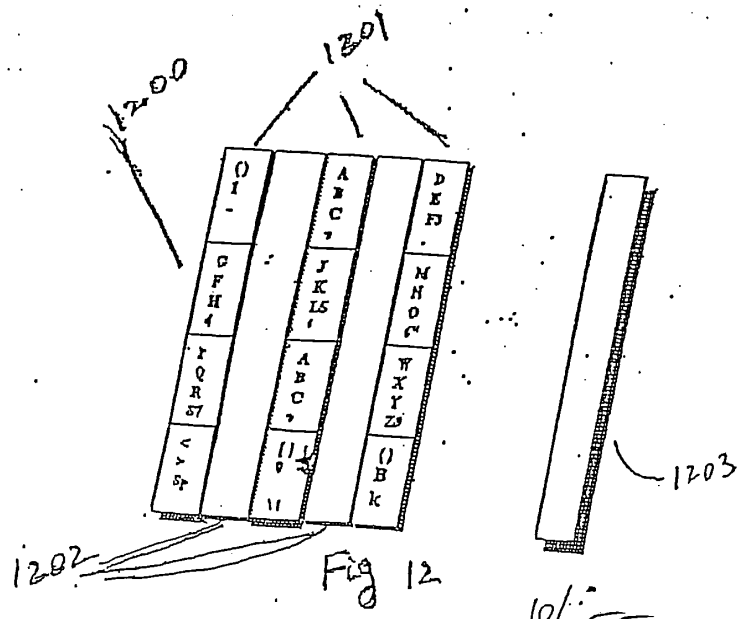
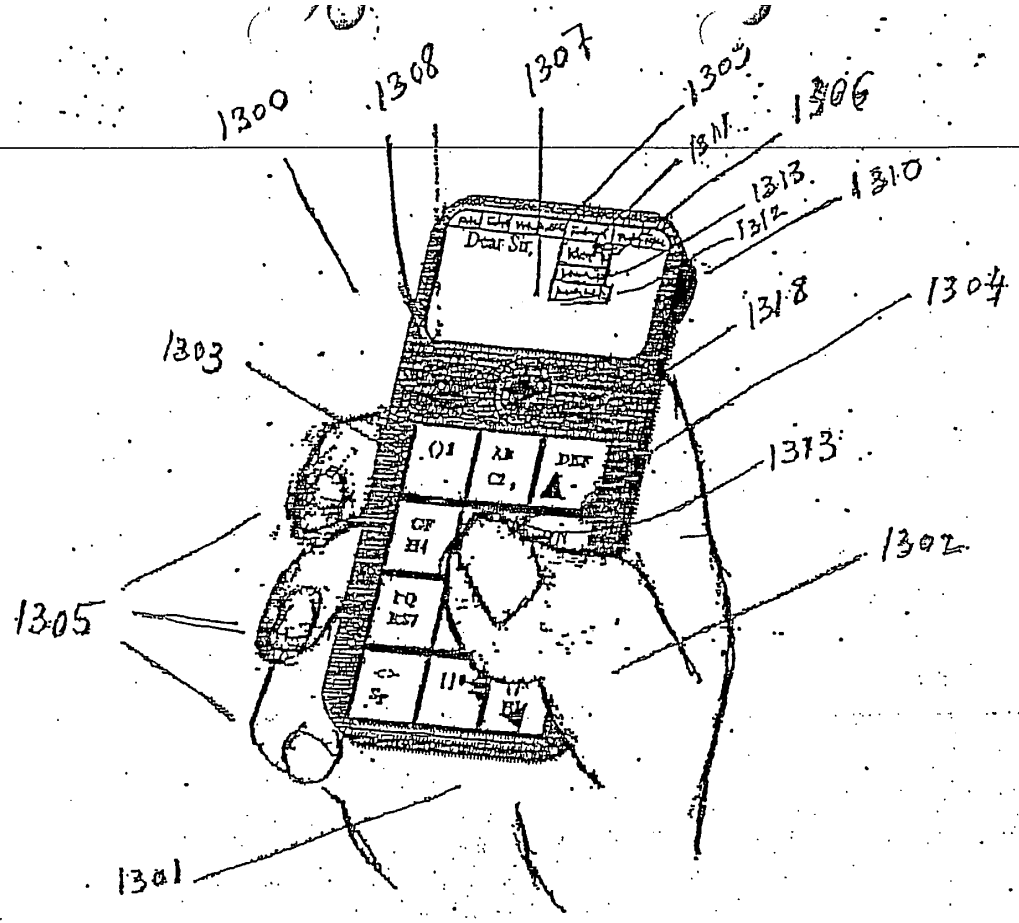


Fig 12

10/55


1300
1308
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1318
1304
1303
1313
1302
1305
1301
Dear Sir,

Fig. 13

11/55

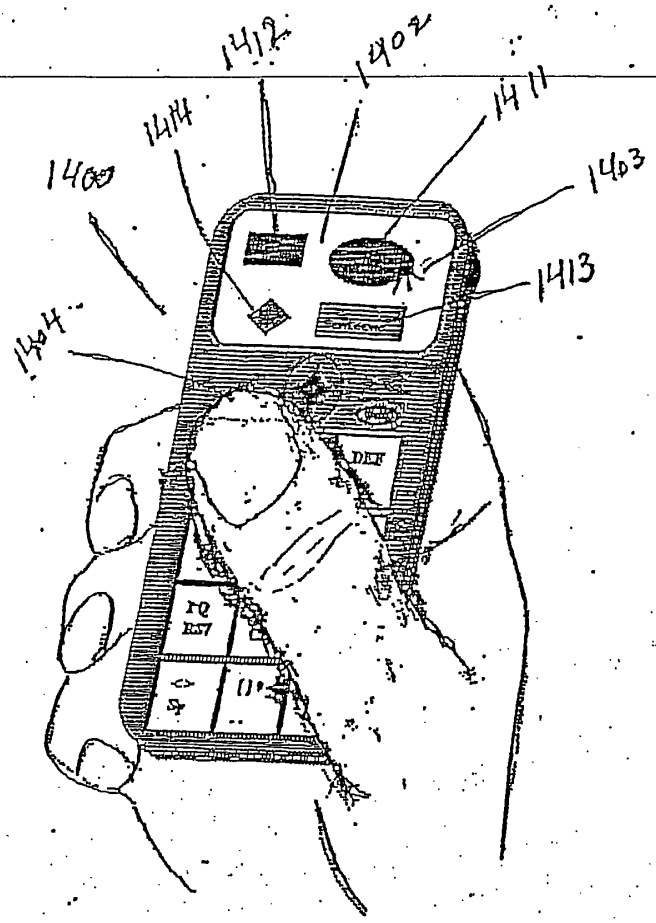

Fig 14

12/55

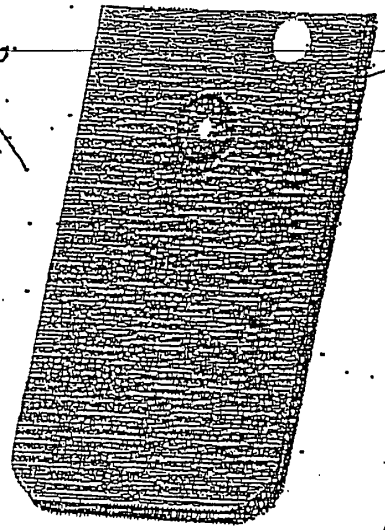

Fig 15

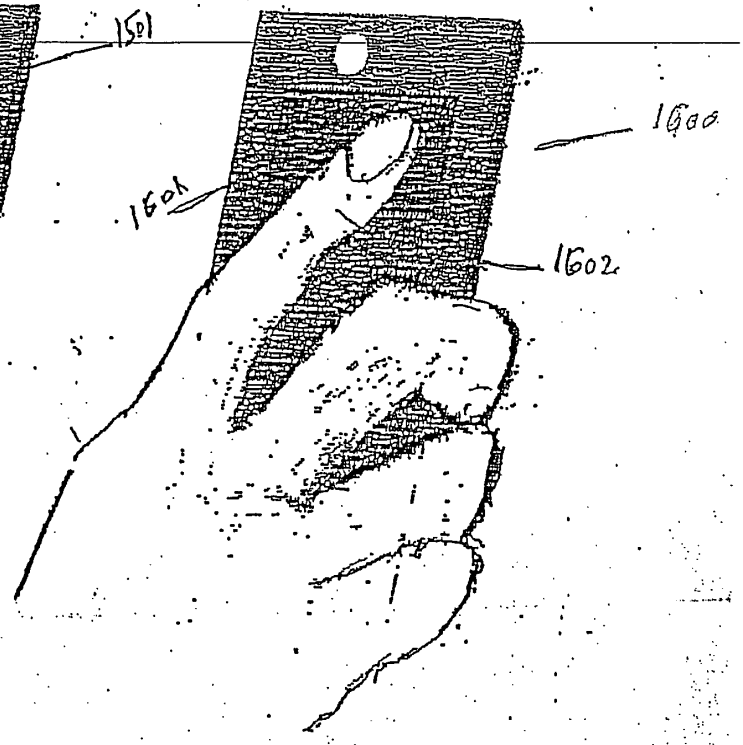

Fig 16

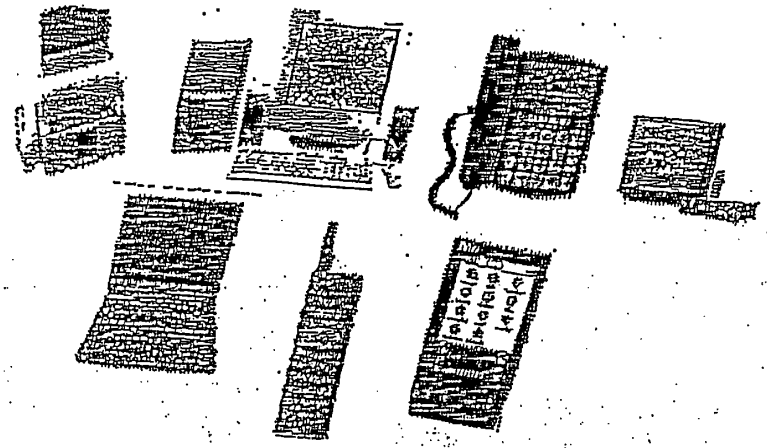

Fig 17

14/55

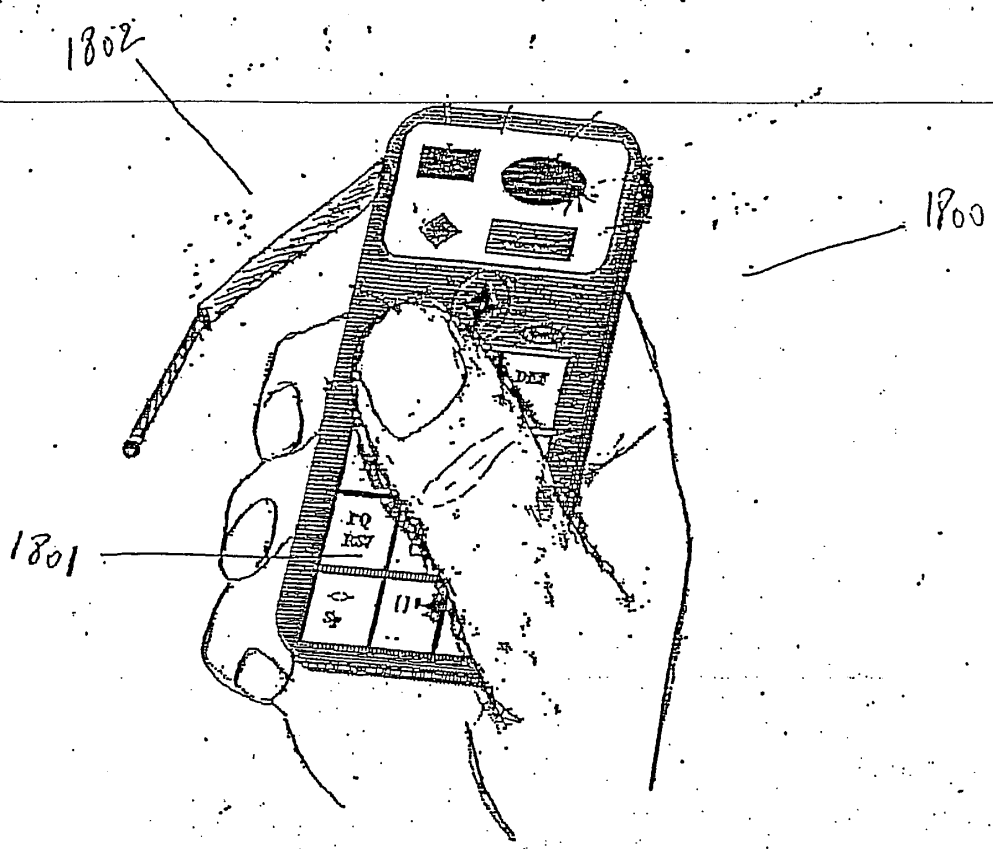

Fig 18

15/55

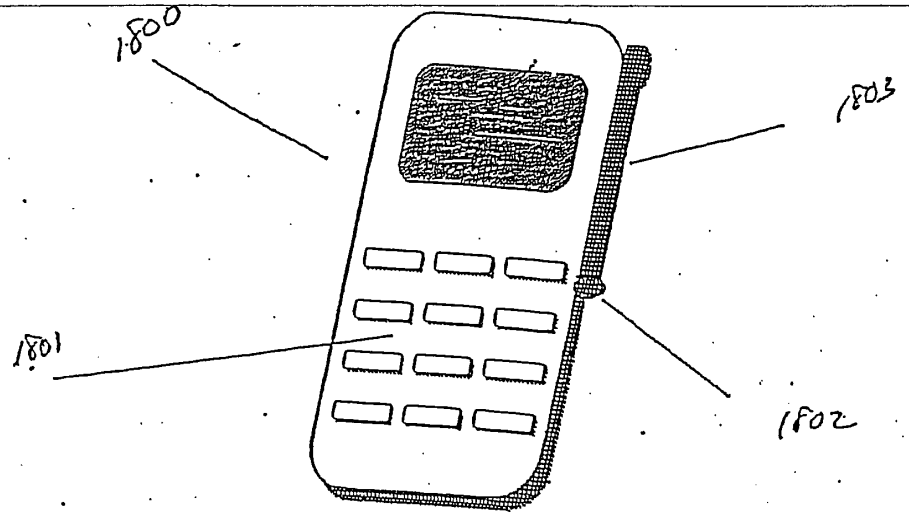

Fig. 18B

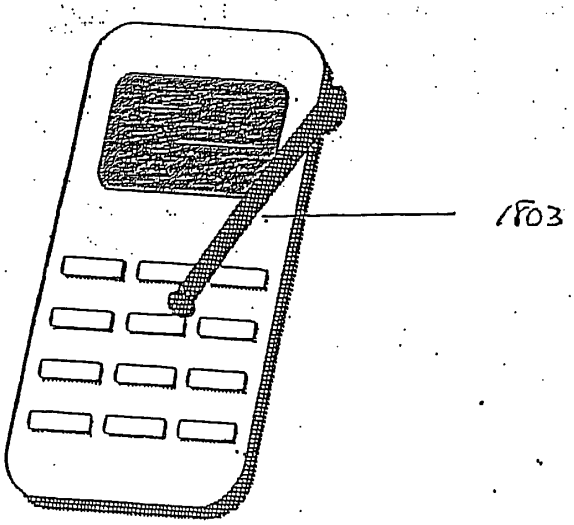

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Fig 18C

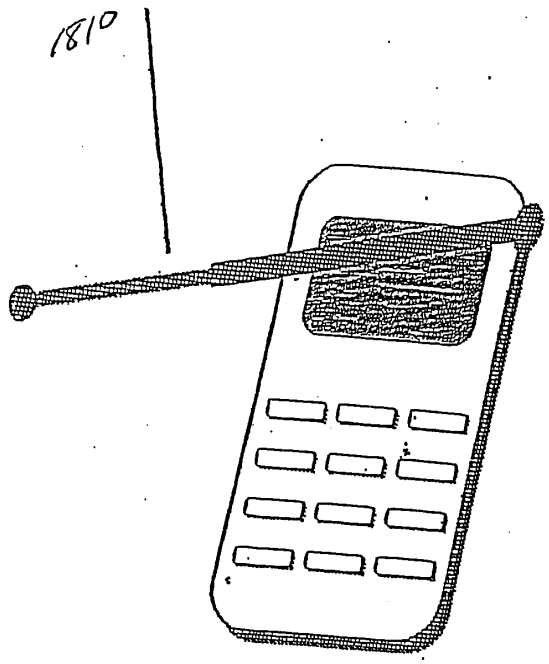

Fig 18D

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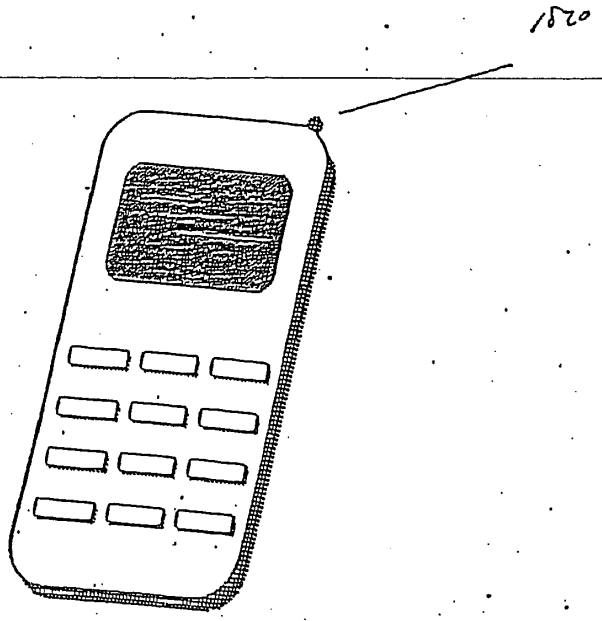
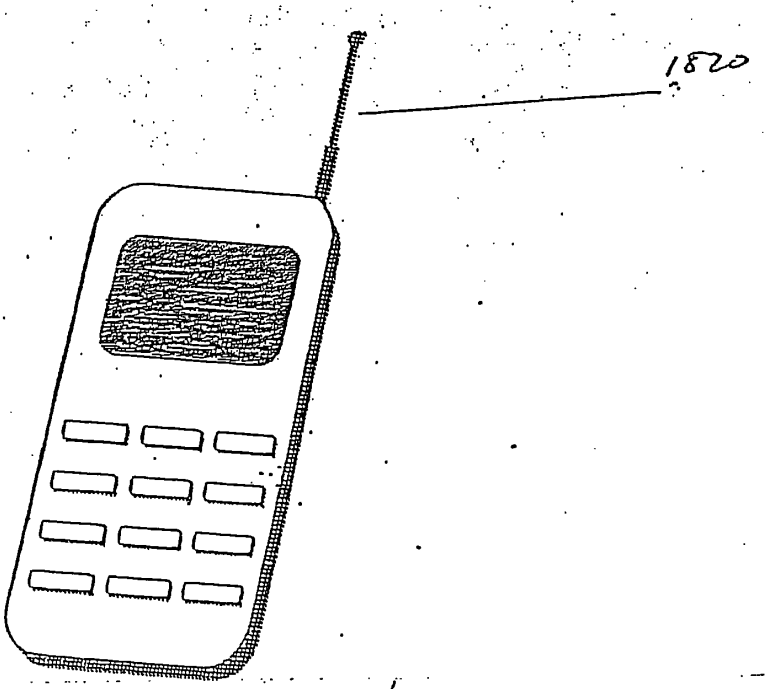


Fig 18E



18/55

Fig 18F

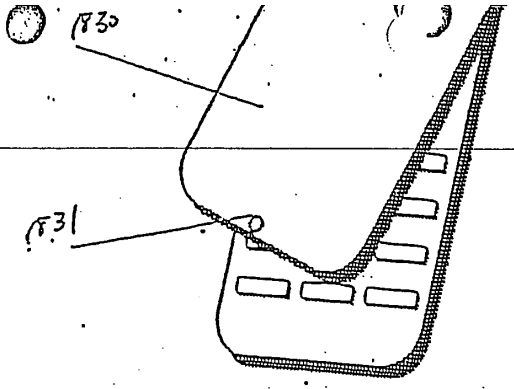


Fig 18G

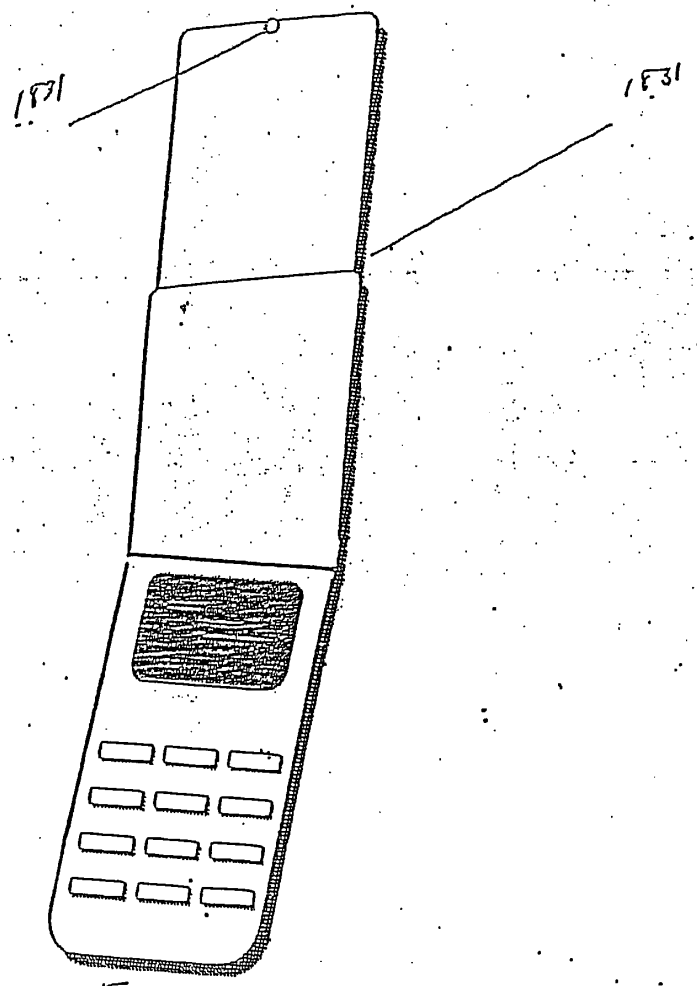


Fig. 18H

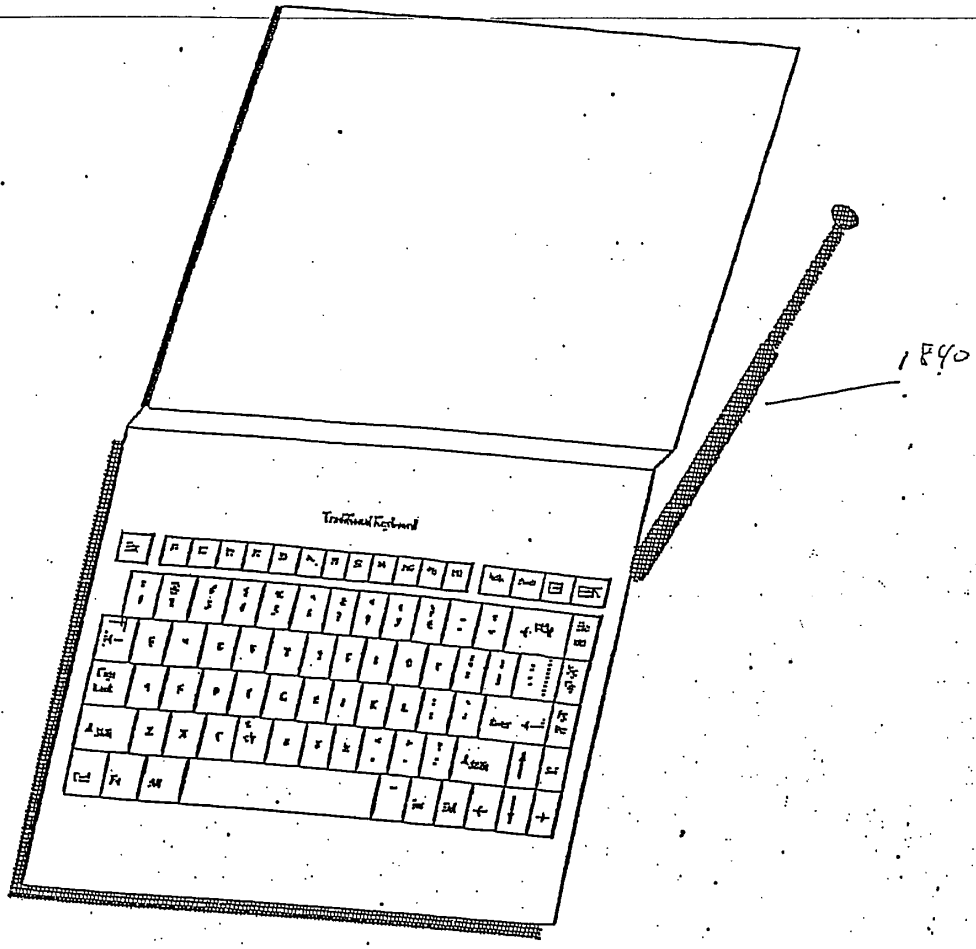


Fig 18I

20/55

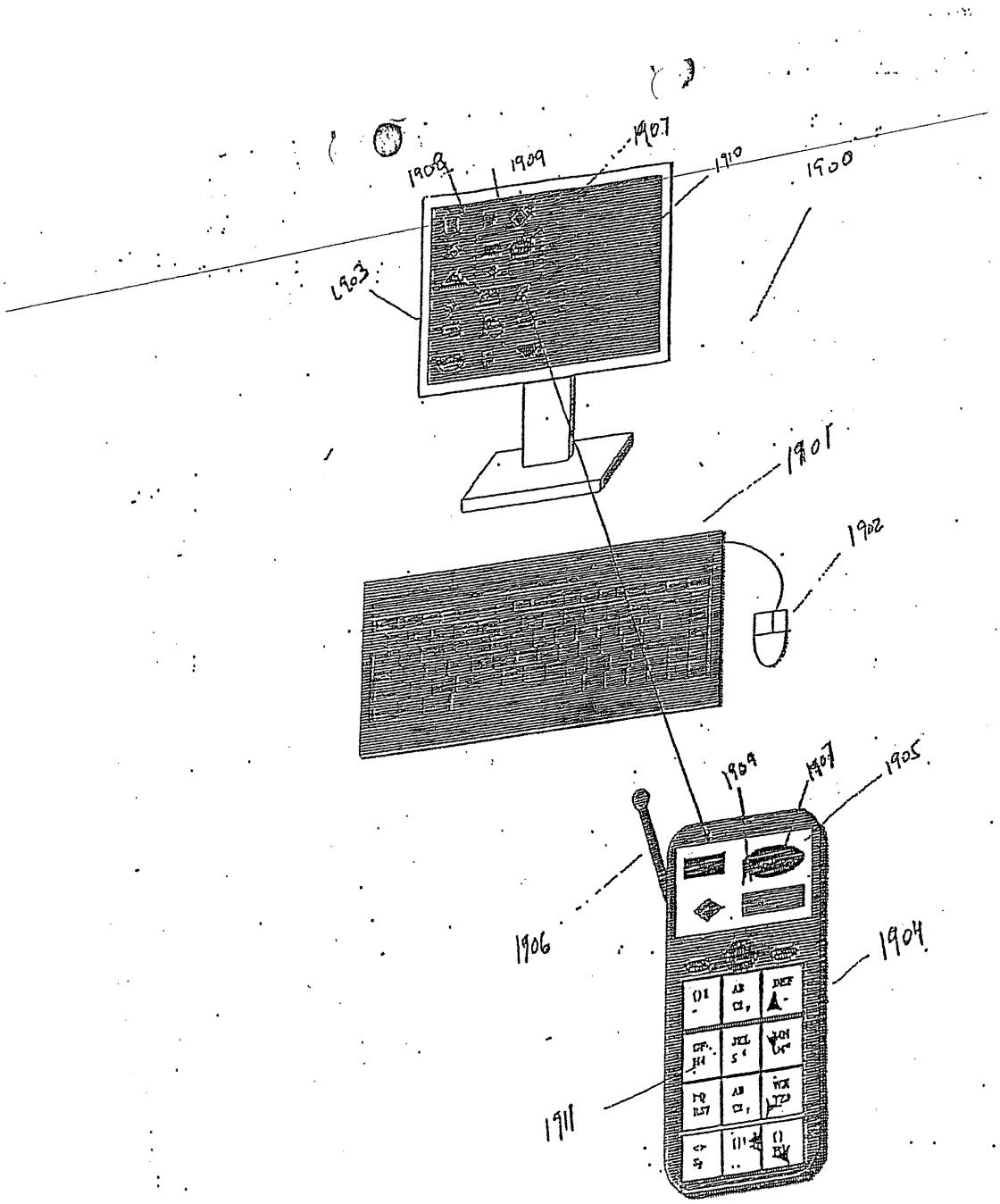

1908
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Fig 19

21/55

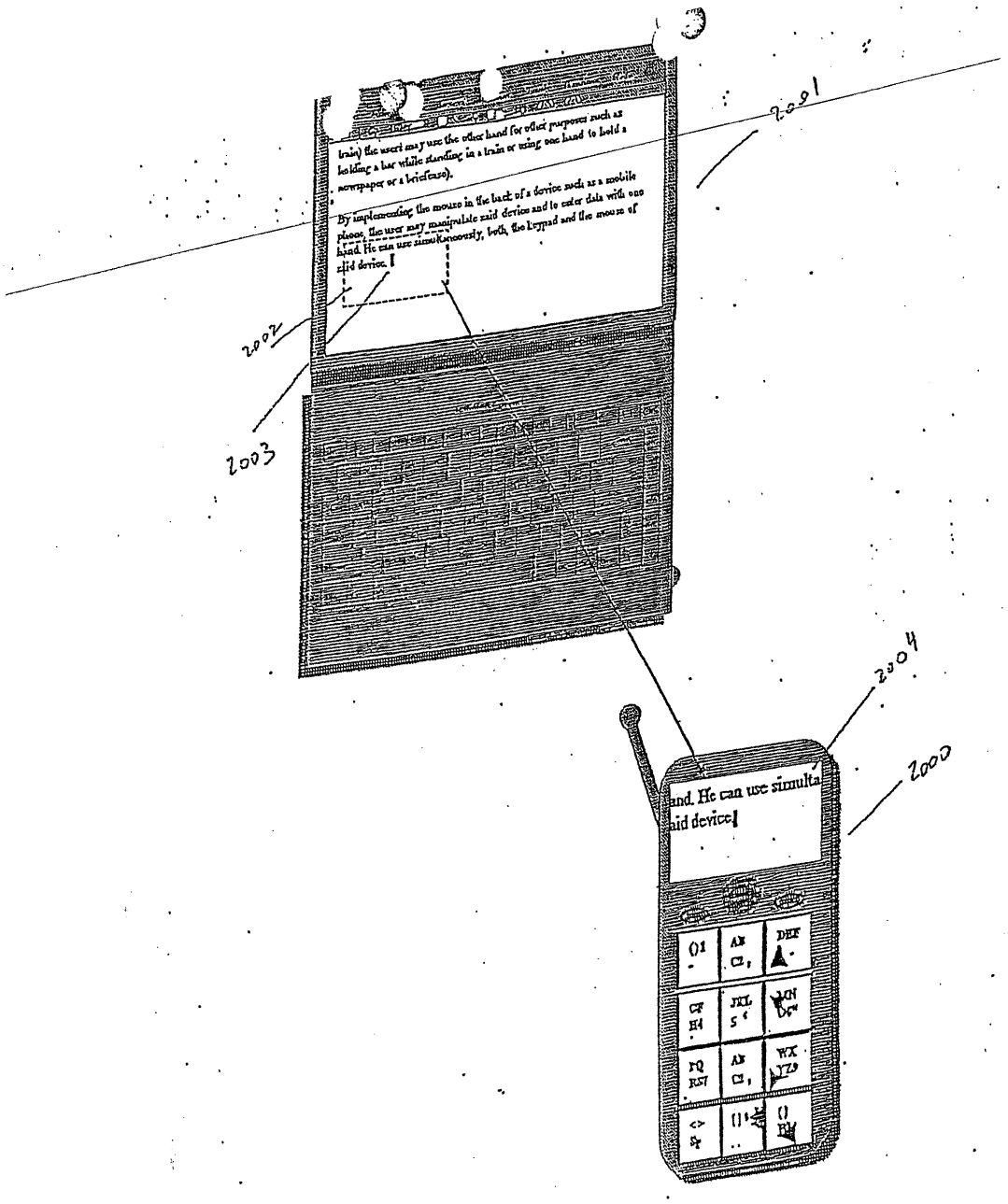

train) the user may use the other hand for other purposes such as
holding a bar while standing in a train or using one hand to hold a
newspaper or a briefcase).
By implementing the mouse in the back of a device such as a mobile
phone, the user may manipulate said device and to enter data with one
hand. He can use simultaneously, both the keypad and the mouse of
said device.
and. He can use simulta
aid device
2001
2002
2003
2004
2000

Fig 20

22/55

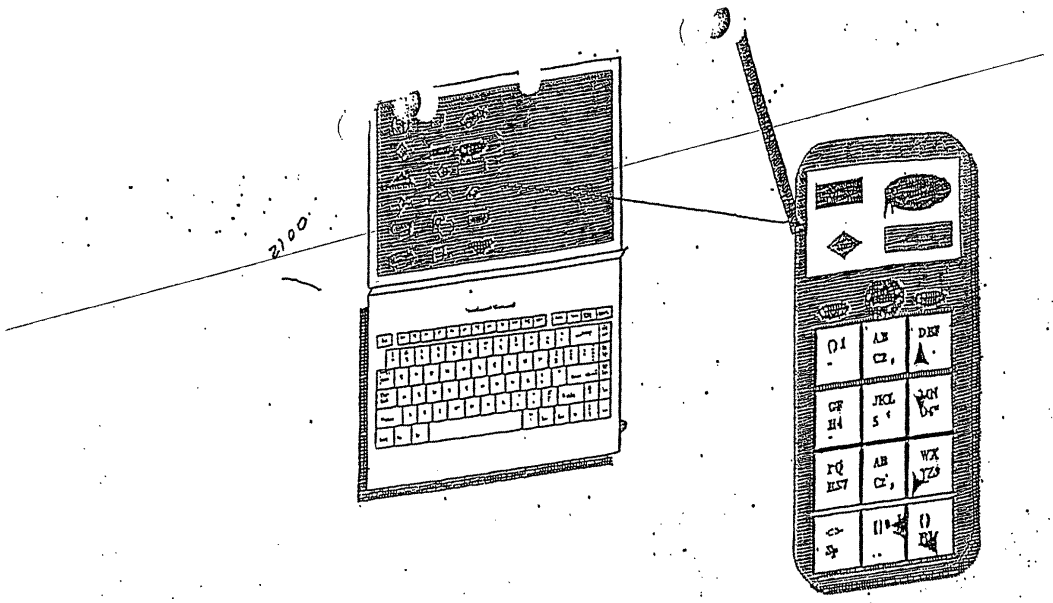
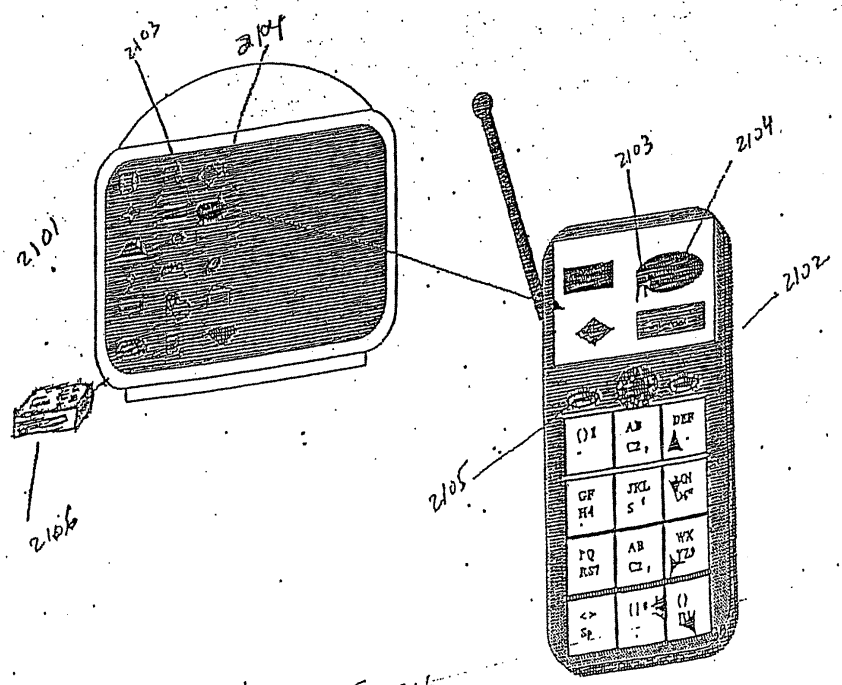


Fig 21a



7/55 Fig 21b

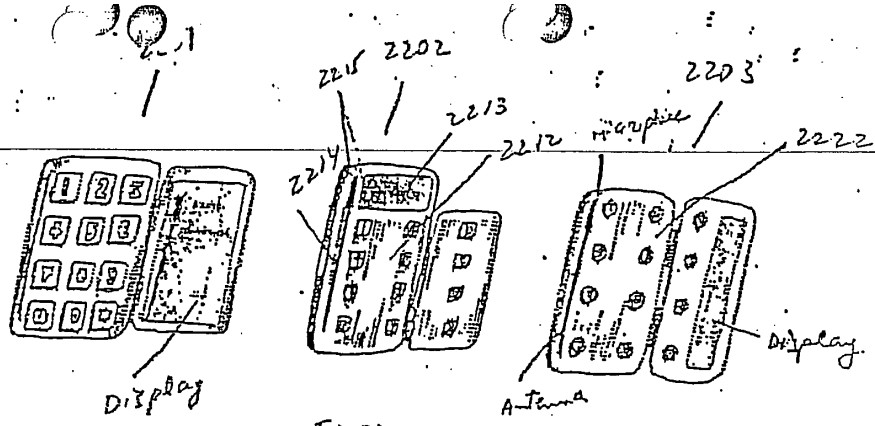


Fig 22a

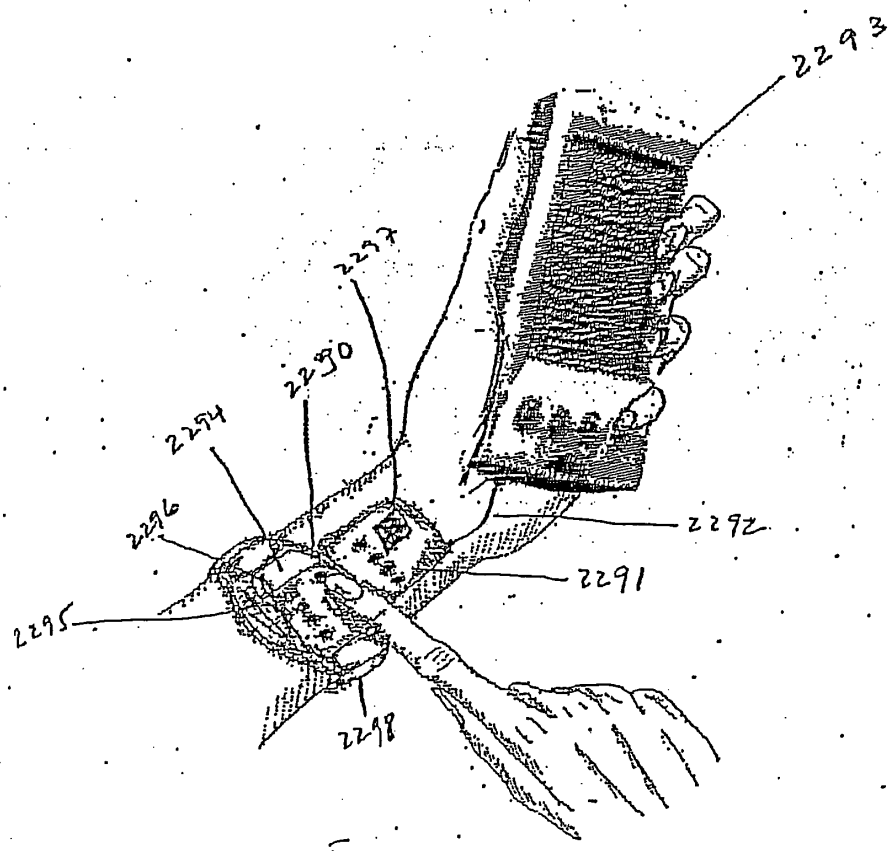


Fig 22b

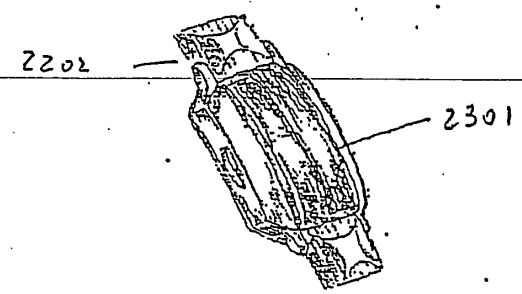


Fig. 23a

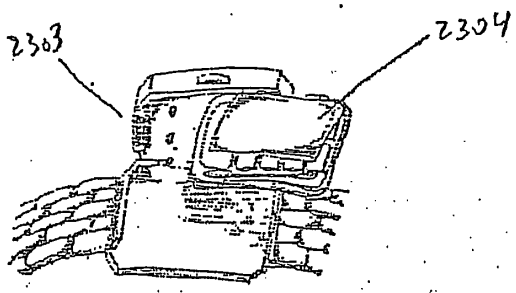


Fig. 23b

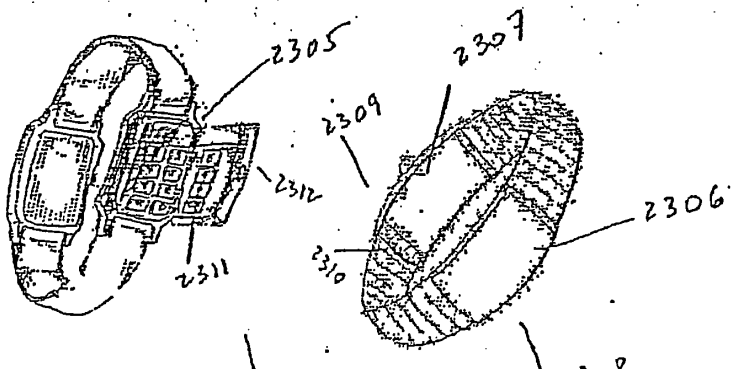


Fig. 23c

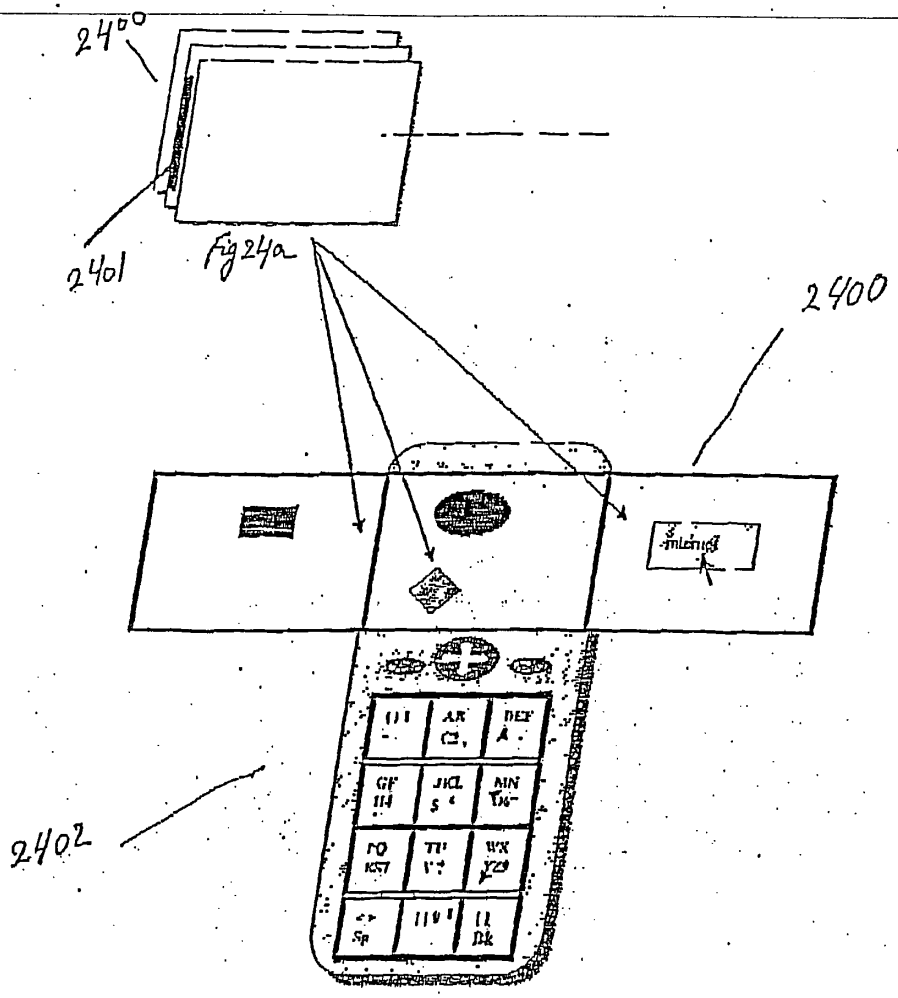


Fig 24b

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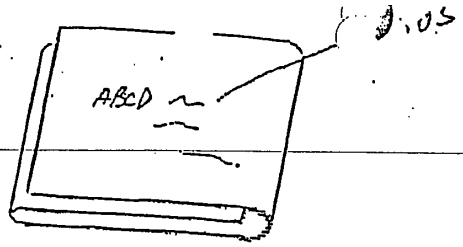

Fig 25a

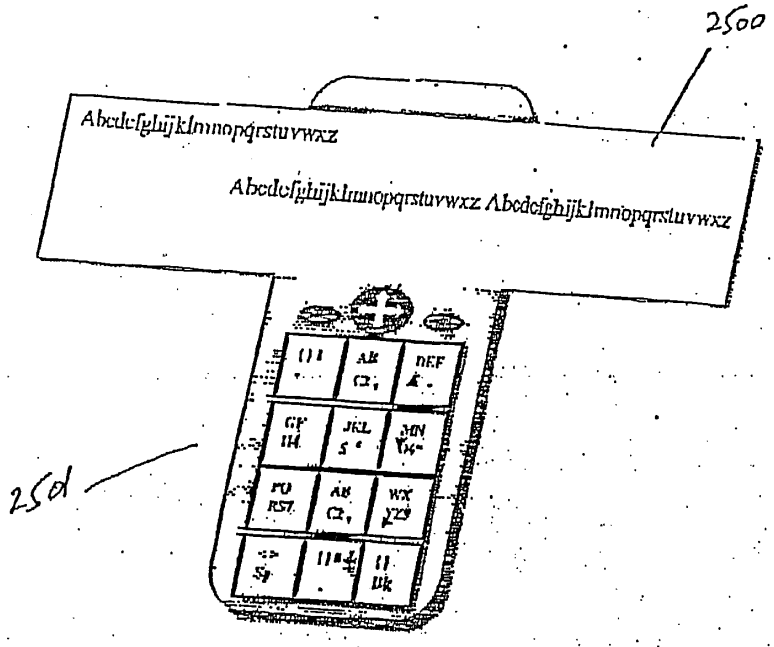

Fig 25b

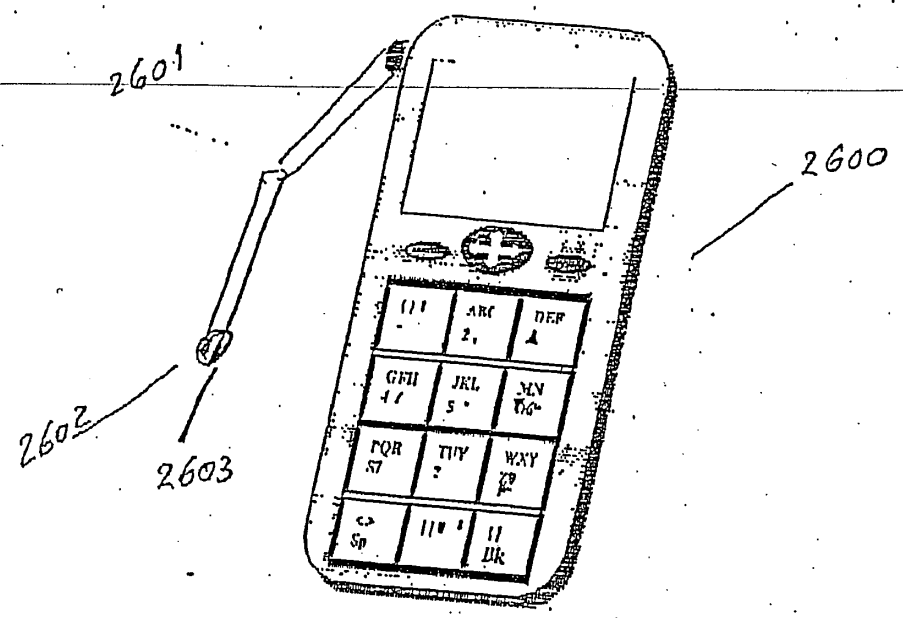

Fig26

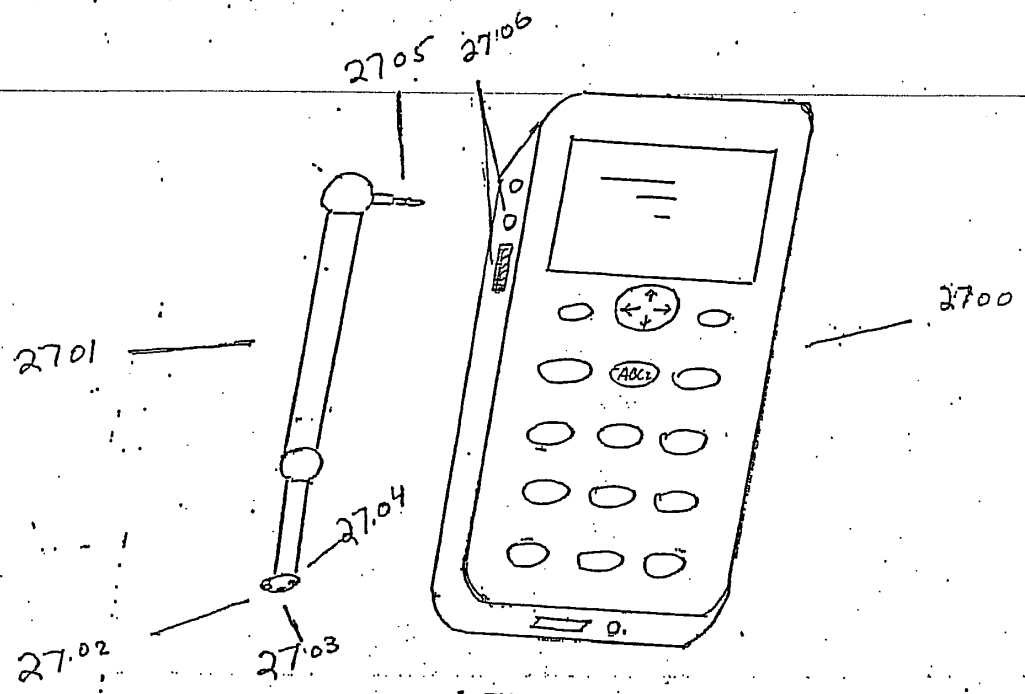

Fig 27

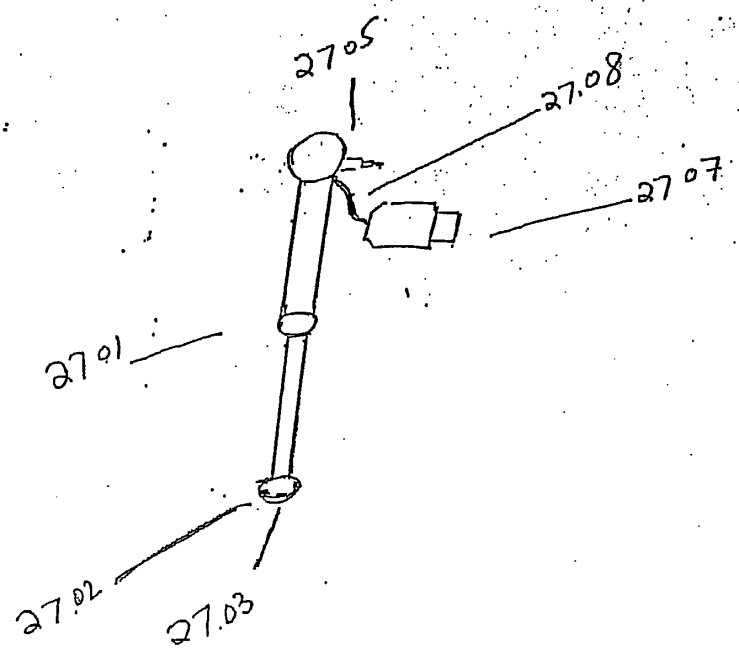

Fig. 27a

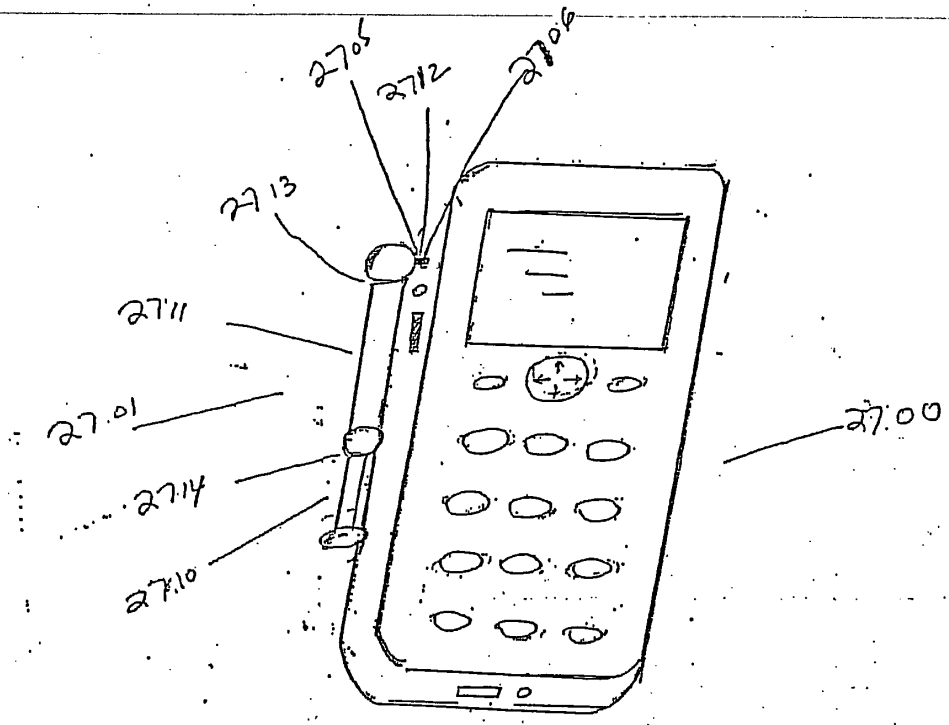

Fig 27.6

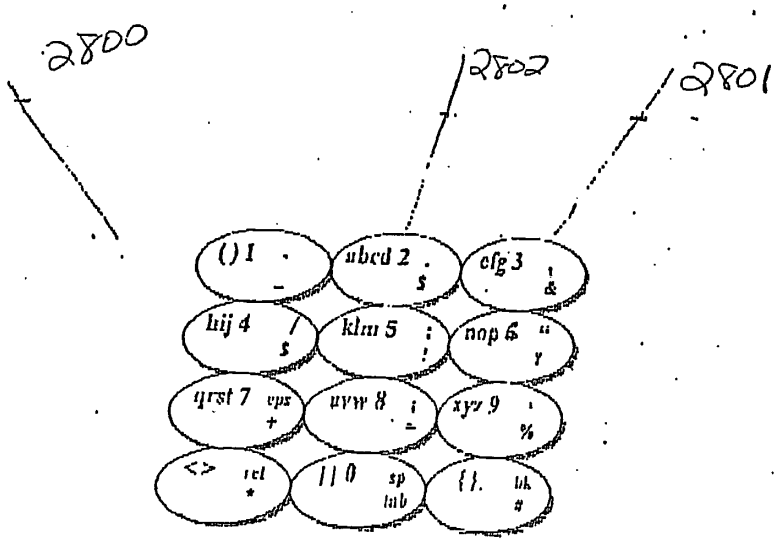

Fig. 28

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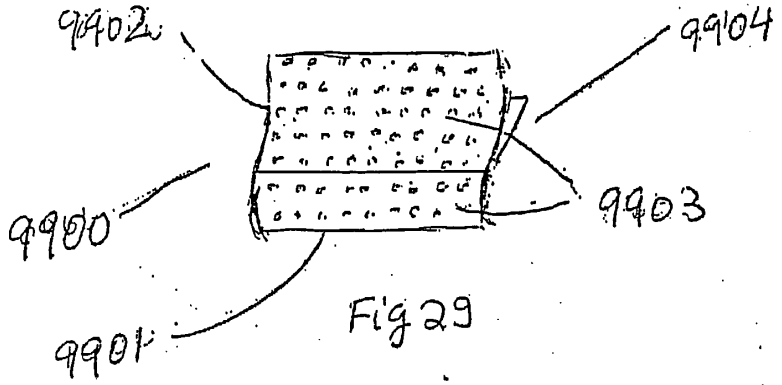

Fig 29

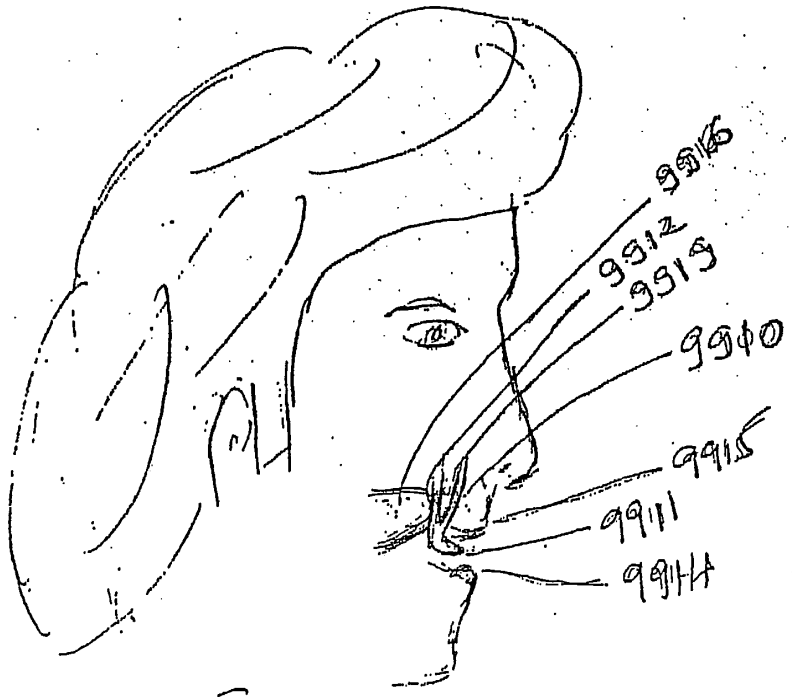

Fig 29a

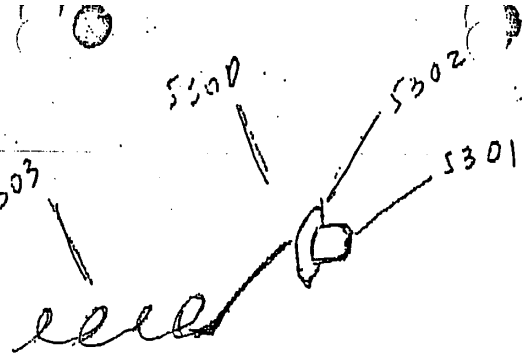

Fig 30

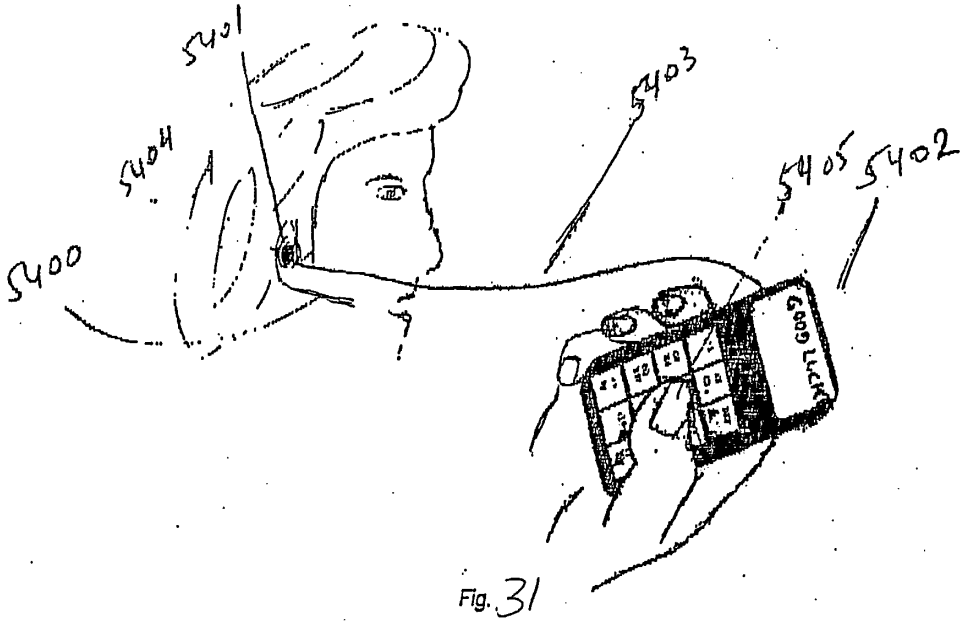

Fig. 31

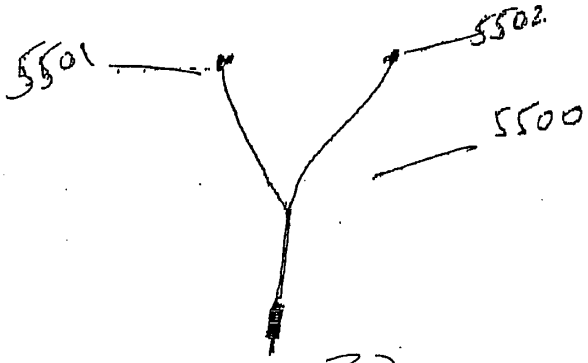

Fig. 32

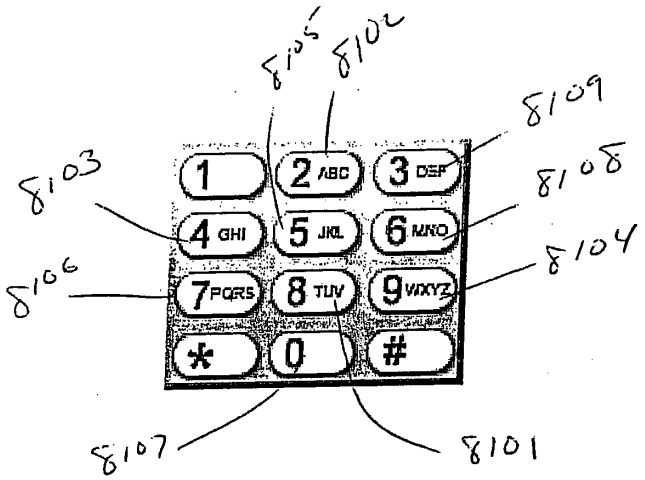
8105
8102
8109
8103
8108
8104
8106
8107
8101
1
2 ABC
3 DEF
4 GHI
5 JKL
6 MNO
7 PQRS
8 TUV
9 WXYZ
*
0
#

fig. 81

8200

A whole word dictionary data base

8201

Whole Words (by characters) Dictionary (8202)	Corresponding key presses (8203)	Corresponding phoneme sets (e.g. lexicon) (8204)	Corresponding speech models (8205)
And	263	and	#n
"	"	"	"
Ball	2255	bôll	#n+i
Dancing	3262464	Dancing	#n+j
Enter	36837	Enter	"
"	"	"	"
Trying	879464	Trīing	"
Tea	832	Tē	#n+k
Teabag	832224	Tēbag	"
Tee	833	Tē	#n+k
Young	96864	Yung	"
Zen	936	Zen	#n+j

Fig. 82

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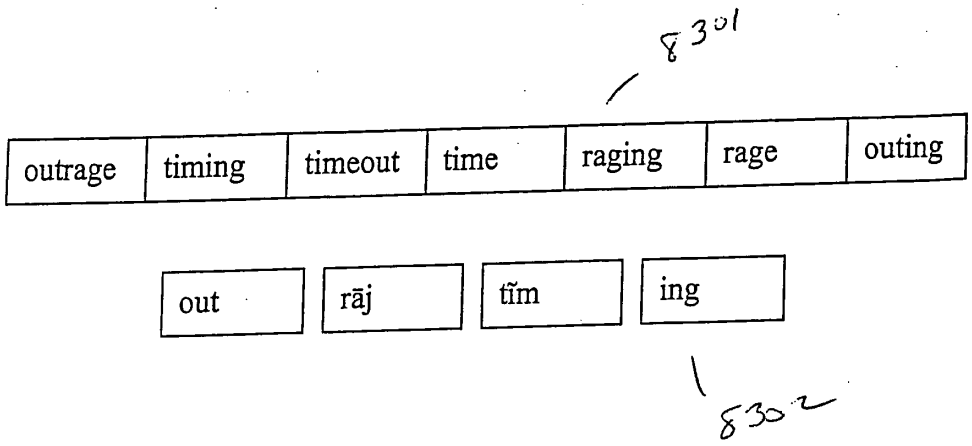
8301
outrage
timing
timeout
time
raging
rage
outing
out
rāj
tīm
ing
8302

Fig. 83

8404 8403 8401

Corresponding (key presses)	Part of the word (e.g. syllable based) character set Dictionary
"	"
224	bag
"	"
464	ing
"	"
832	tea
"	"
833	tee
"	"
8733	tree
"	"
966	zen

Part of the word (e.g. syllable based) phoneme set Dictionary	Corresponding Speech models
"	#1
bag	"
"	"
ing	"
"	"
tē	"
"	"
"	"
Trē	"
"	"
Zen	#n

Whole Words (characters) Dictionary
And
"
Ball
Dancing
Enter
"
Trying
Tea
Teabag
Tee
Young
Zoo

8402

37/55

Fig. 84

A Speech/phonemes at the beginning of a syllable in a word	B Characters sets having pronunciation similar to the phonemes set of A	C words having syllables with starting characters sets of B
ta	ta,	tap, tango
tā	ta, tai,	take, tailor
tā	tas,	taste
tô	ta, tau	talk, taupe
top	top	Top
te	te	tent
ti	ti	tilt
tip	tip	tippet
tī	ti, tie, ty	re-tire ("ti" in the beginning of the middle syllable), tiebreak, type
tē	t, tee, tea, ty	t, teeth, team, security
tōō	to, too, two	to, tooth, two
trī	tri, try	tried, re-try
thi	thi, thir, thirst	thin, thirst, thirst
thrō	thro	throw
ing	in	trying

Fig. 85

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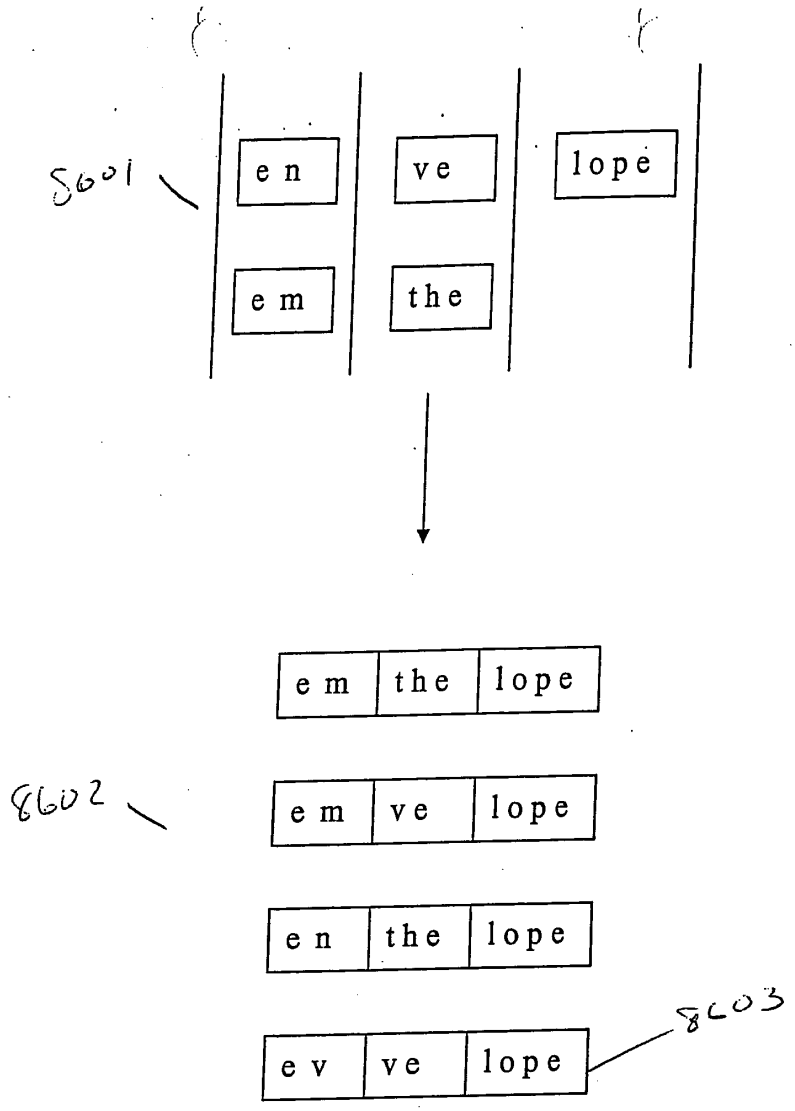
8601
en
ve
lope
em
the
em
the
lope
8602
em
ve
lope
en
the
lope
8603
ev
ve
lope

Fig. 86

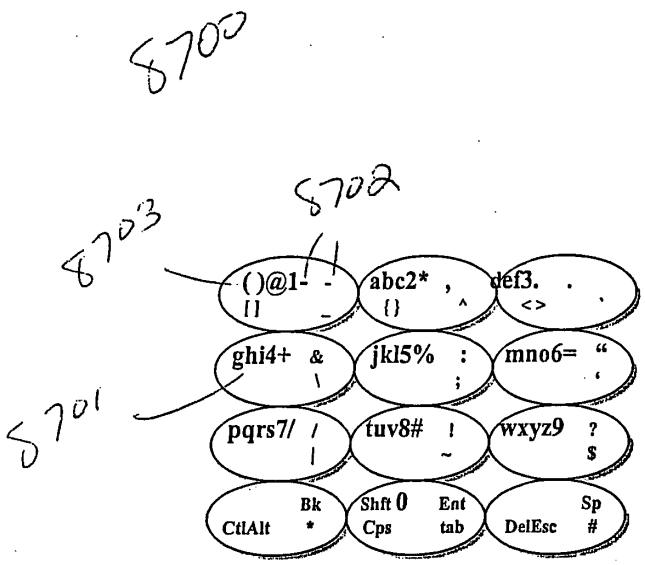
8700
8702
8703
8701
( )@1- -
[ ] _
abc2* ,
{ } ^
def3. .
< > .
ghi4+ &
\
jkl5% :
;
mno6= "
'
pqrs7/ /
|
tuv8# !
~
wxyz9 ?
$
Bk
CtlAlt *
Shft 0
Cps
Ent
tab
Sp
DelEsc #

Fig. 87

40/55

Phoneme-Set	Consonant	Vowel	Consonant	Word	Number of Key Presses
T					
t,	t			thir-s-t	3
ta	t	a		ta-riff	2
tab, tac, …..	t	a	b	tab-let	2
tā	t	ā		s-ta-ble	3
tār, …..	t	ā	r	s-tair	2
te	t	e		te-nan-t	3
tem, ter, ….	t	e	m	tem-pe-ra-ture	4
tē,	t	ē		tea-bag	2
tēch, tēm,….	t	ē	ch	teach-ing	2
ti	t	i		mul-ti-tude	3-4
til, tip, …..	t	i	l	un-til	2
to	t	o		to-ma-to	3
tor,	t	o	r	tor-na-do	3
tu	t	u		s-tu-dy	3
tuf, tud, …..	t	u	d	s-tuff/s-tuf-f	2-3
tōō	t	ōō		to	1
tōōd, tōōl, …..	t	ōō	l	un-der-s-tood	4
tyōōn	t	yōō	n	tune/tu-ne	1-2
U					
yōō		yōō		u-ni-ver-sal	4
yōōz		yōō	z	use/u-se	1-2
un, um, ul, ….		u	n	un-der	2
V					
Similar principles as for "T"					
TH					
Similar principles as for "T"					

Fig. 88

Phoneme-Set	Consonant	Vowel	Word	Number of Key Pressees
T				
t	t		thi-r-s-t	4
ta	t	a	ta-ṛi-f-f	4
tā	t	ā	s-ta-b-le	4
te	t	e	te-na-n-t	4
tē,	t	ē	tea-ba-g	3
ti	t	i	mu-l-ti-tu-de	5
to	t	o	to-ma-to	3
tu	t	u	s-tu-dy	3
tōō	t	ōō	to	1
tyōō	t	yōō	tu-ne	2
U	Vowel	consonant		
yōōz	yōō		u-se	2
un, um, ul, ...	u	n	un-de-r	3
V				
Similar principles as for "T"				
TH				
Similar principles as for "T"				

8901

Fig. 89

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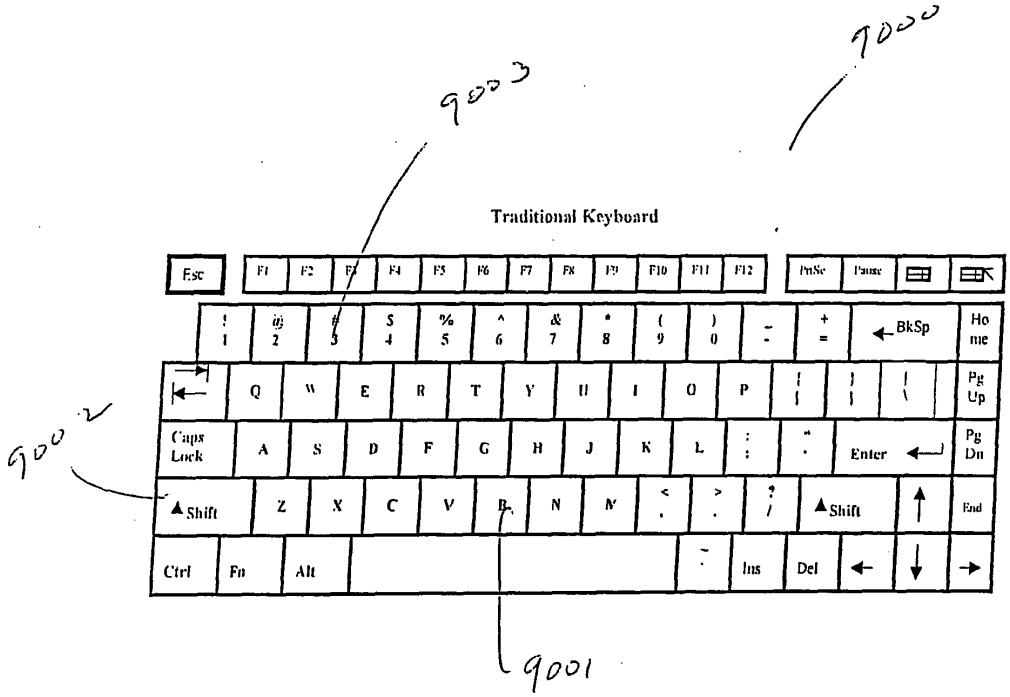

Fig. 90

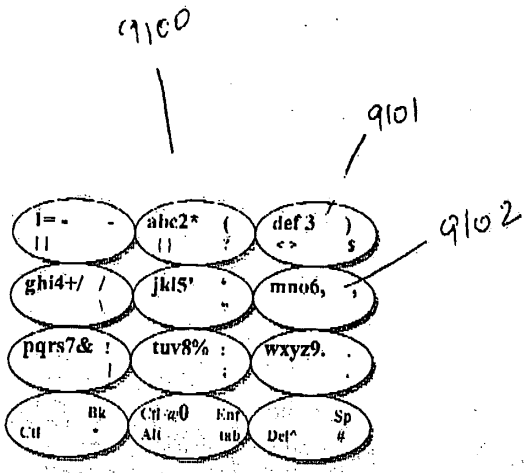

Fig. 91a

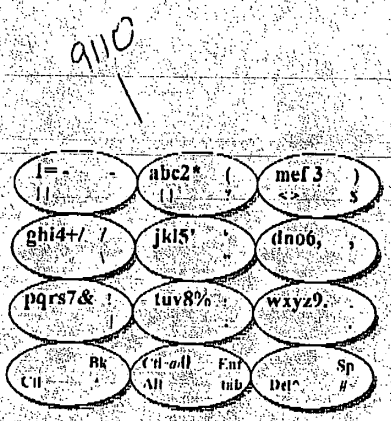

Fig. 91b

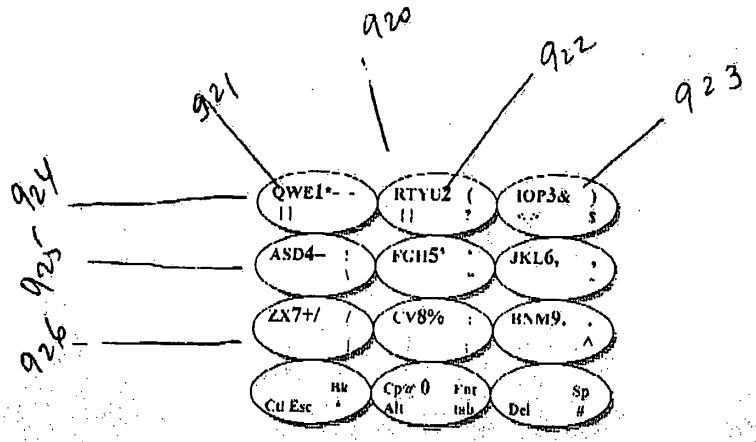

Fig. 92a

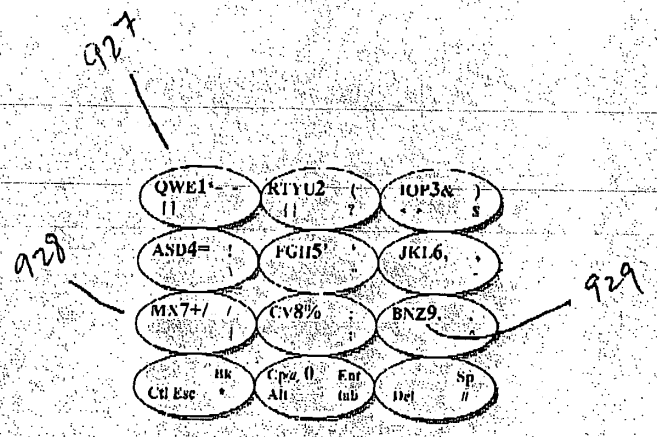

Fig. 92b

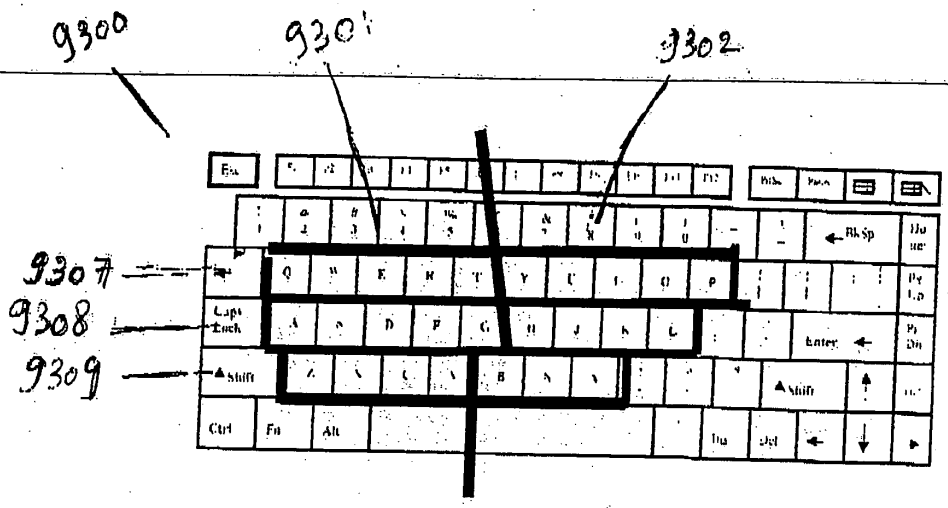

Fig. 93

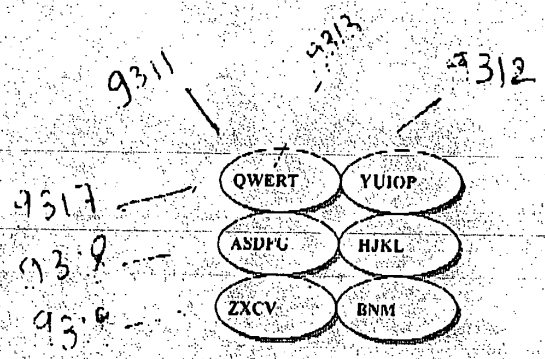

Fig. 93a

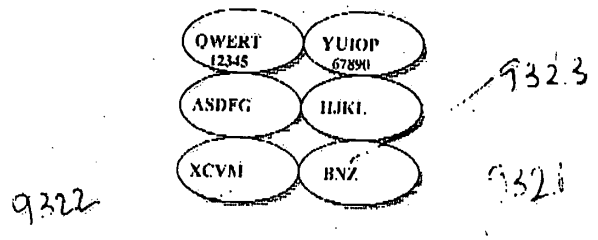

Fig. 93b

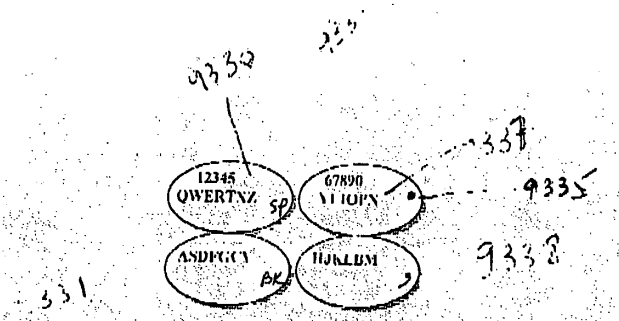

Fig. 93c 9322

Fig. 93d

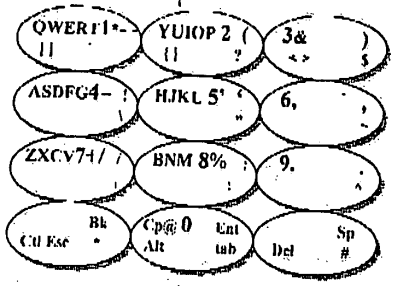

Fig. 94a

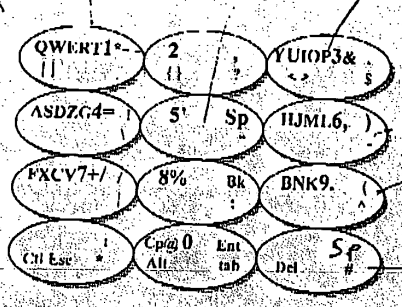

Fig. 94b

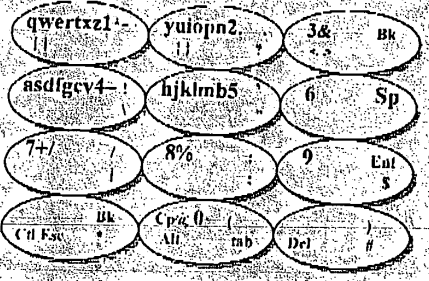

Fig. 94c

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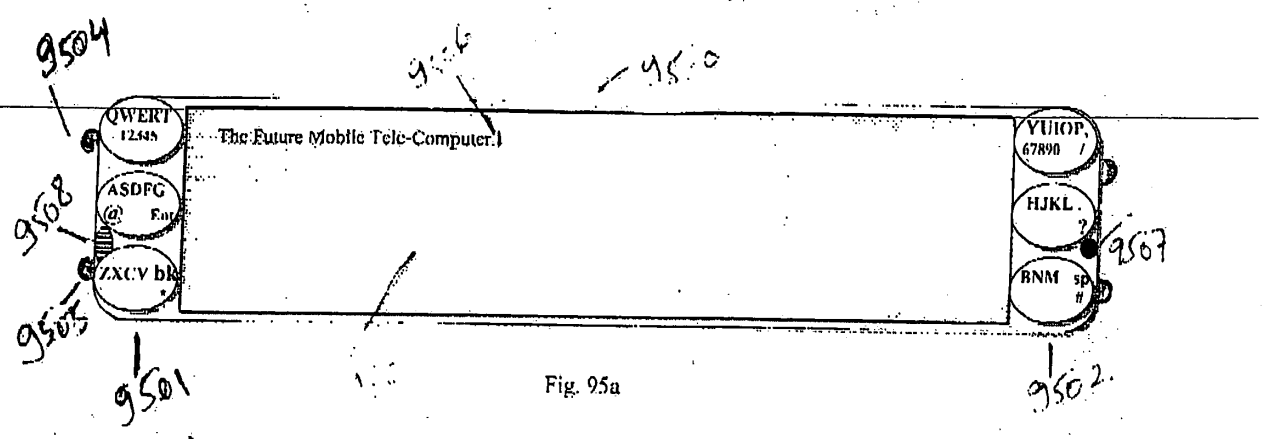

Fig. 95a

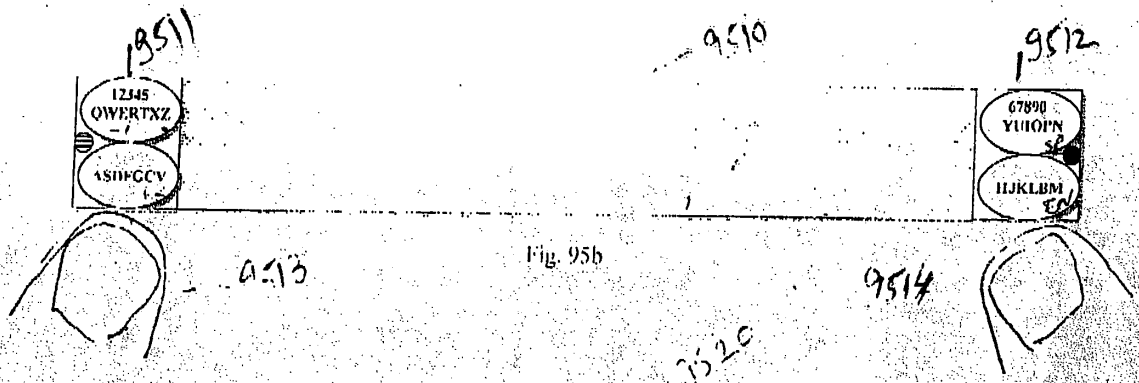

Fig. 95b

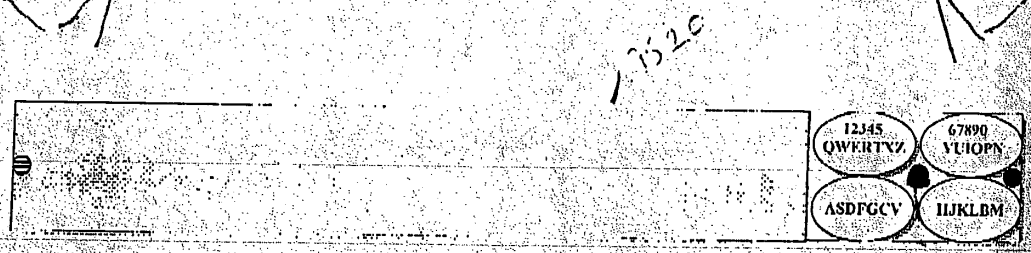

Fig. 95c

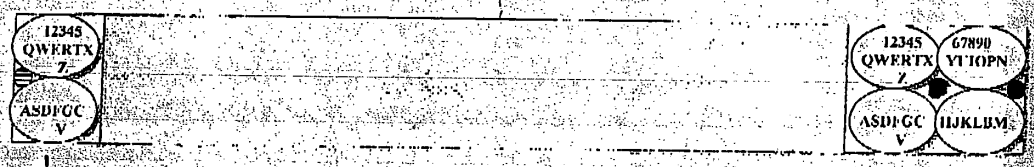

Fig. 95d

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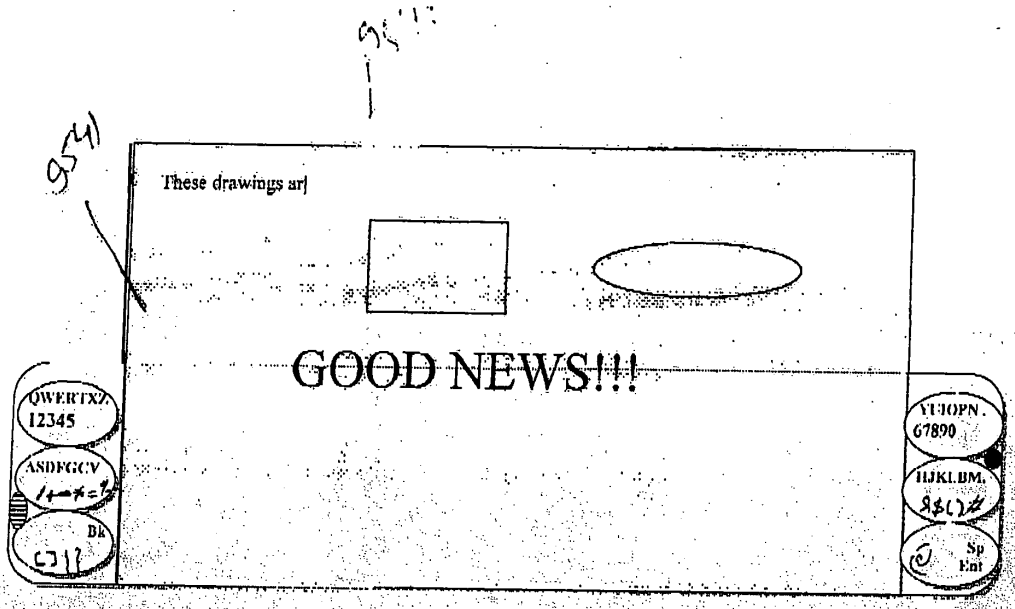


Fig. 95c

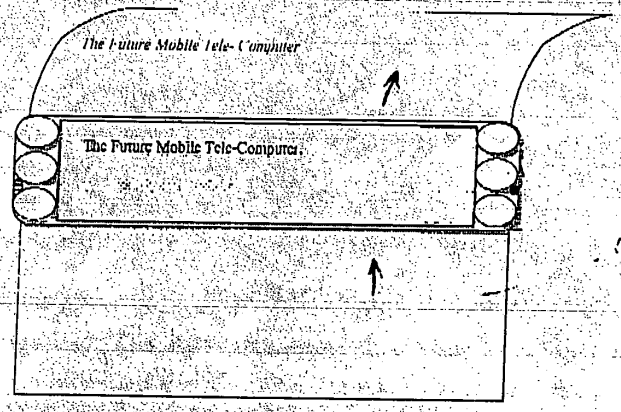


Fig. 95f

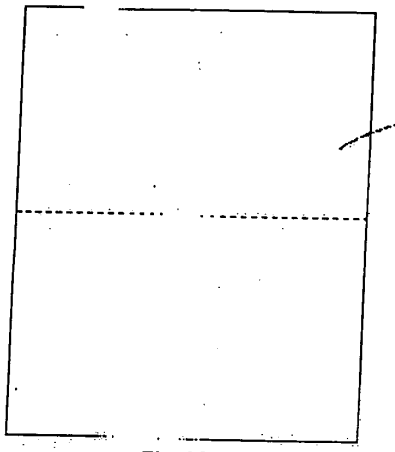


Fig. 95g

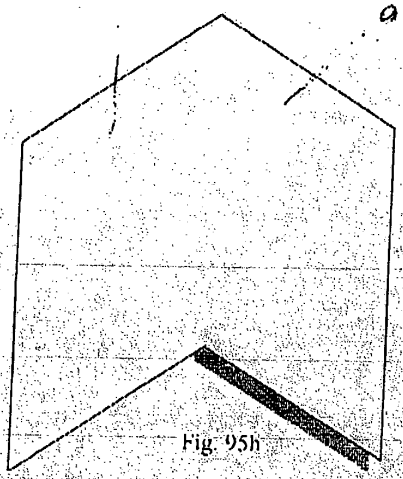


Fig. 95h

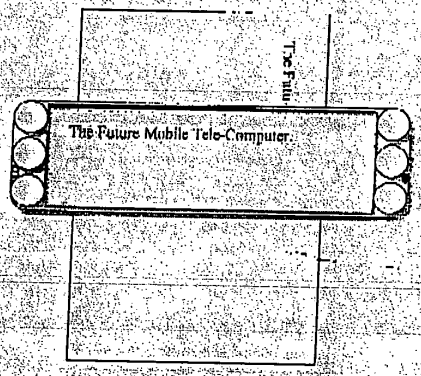


Fig. 95k

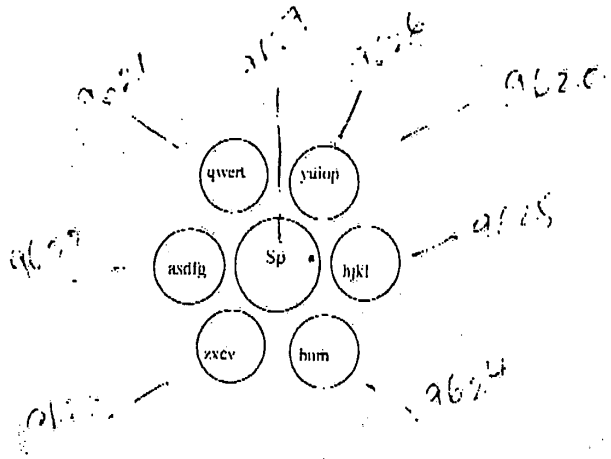


Fig. 7

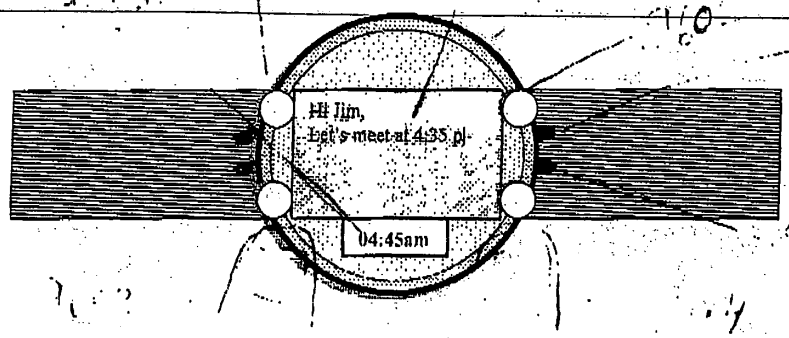


Fig. 96a

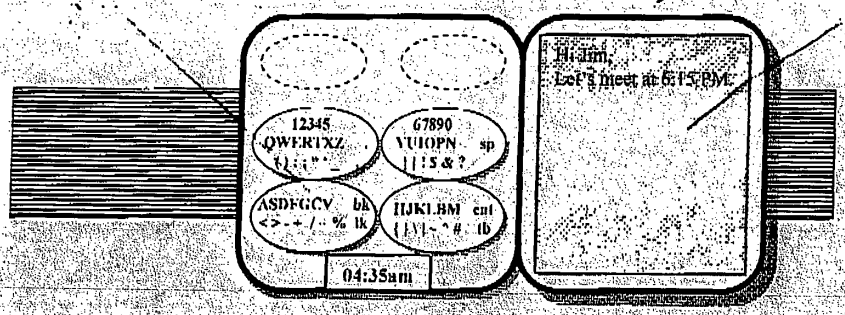


Fig. 97a

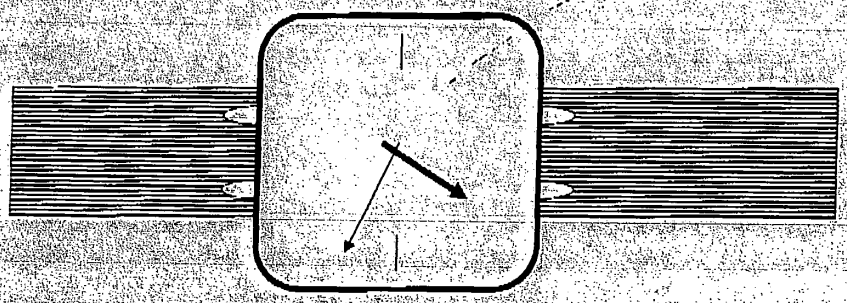
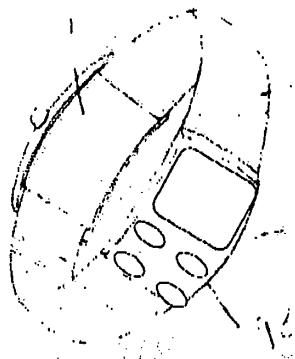
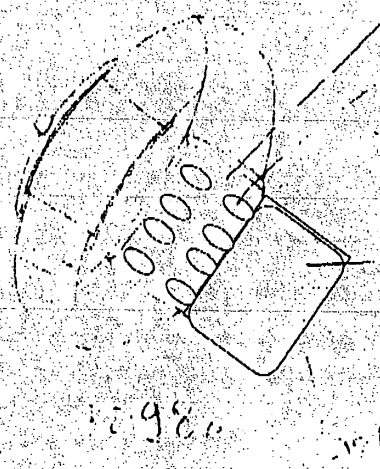


Fig. 97b



18a



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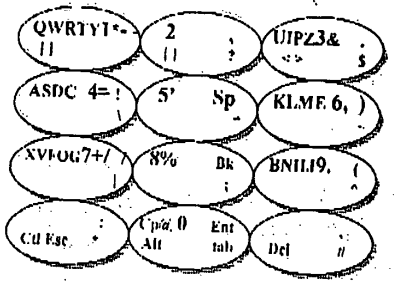

Fig. 99

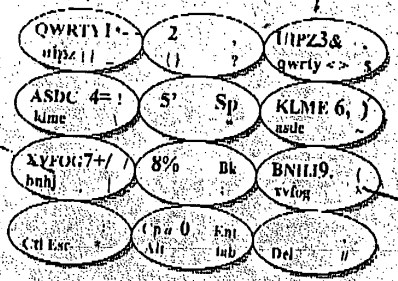

Fig. 99a

Fig. 99b

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