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**(54) Word search device, method, and program**

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Dispositif, procédé et programme de recherche de mots

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## Description

**[0001]** The present invention relates to a word search device, method, and program that are preferably used for assisting the work upon solving or creating a cryptic crossword.

**[0002]** A crossword puzzle, which may be referred to simply as "crossword", is a wordplay whose goal is to fill blank areas that correspond to a predetermined number of characters and extend vertically or horizontally by using the answer words to a given clue, and to thereby place a plurality of words within a grid. For the crossword, there are provided devices for assisting the work of searching for a word forming the answer (see, for example, JP 06-149782 A and JP 07-325845 A). Those devices are configured to set an uncertain character for a part of a word having a predetermined number of characters, and search a predetermined word list while replacing the uncertain character by a plurality of types of characters to retrieve candidates for a word forming the answer.

**[0003]** There is another device for solving the crossword, which has a function of searching a word list while automatically replacing one or a plurality of characters of an inputted word having a predetermined number of characters by another character (see US 5,249,965). According to this device, for example, if a word inputted as the answer by a user is suspected to be incorrect, it is possible to present a word established by replacing one or a plurality of characters of the word by another character, as a corrected candidate for the answer.

**[0004]** As another wordplay, there is a game called "Scrabble (registered trademark)". Also for this game, there is a device for searching for an English word. In this game, each player forms a word by vertically or horizontally placing his/her pieces, each representing one letter of the alphabet, on a board having a grid, and a value of his/her score is determined according to the used letters and the positions where the pieces are placed on the board. In Scrabble, each time the player places his/her piece, a space for placing a new piece decreases. Therefore, unlike the crossword, the number of characters of a word to be formed is not constant but varied. Accordingly, in the device for searching for a word for Scrabble, the player sets usable types of piece and inputs conditions related to a layout of pieces that have already been placed on the board and a score to thereby make it possible to present a list of English words that can be formed along with scores to make (see US 5,435,564).

**[0005]** Meanwhile, a cryptic crossword, which is a wordplay being a subject of the present invention, is a special type of crossword characterized in that a clue thereto is a word puzzle itself. In general, the clue does not make the answer by surface reading, and one of the goals is to seek the solution to how to read the clue in order to be lead to the answer. The clue generally contains one or a plurality of character strings (a plurality of characters containing one or a plurality of words), each

of which has a special meaning, called "indicator" or "code word". The indicators each indicate a predetermined condition related to a wordplay existing between a word forming the answer and the character string composing the clue, and are classified into some types.

**[0006]** For example, the word "mashed" is used as the indicator that indicates that the word forming the answer and the character string composing the clue have a relationship of being anagrams of each other. The indicator is classified as being of the type "anagram". That is, indicators that are classified as being of the type "anagram" indicate that the word forming the answer and the character string composing the clue have the relationship of being anagrams of each other. For example, if the clue contains the words "mashed" and "live", the word "evil" having the relationship of being an anagram of the word "live" is found as the answer.

**[0007]** In addition to the above-mentioned type "anagram", the types of indicator include: "reversal", which is a special form of "anagram" and indicates the word forming the answer and the character string composing the clue have a relationship of being a reversal of each other; "bridge", which indicates that the word forming the answer extends across two or more words within the clue; "deletion", which indicates that the word forming the answer is equal to one word that is contained in the clue and has the characters partially deleted; "burial", which is a special form of "deletion" and indicates that a character string including the deleted characters represents another word; and "homophones", which indicates that the word forming the answer and the word contained in the clue have a relationship of homophones having different spellings.

**[0008]** As an example of "reversal", there is a case where the answer to the clue "... reversing pots ..." is "stop". As an example of "bridge", there is a case where the answer to the clue "... shudder ...great remorse ..." is "tremor". As an example of "deletion", there is a case where the answer to the clue "... empty bottle ..." is "bole". As an example of "burial", there is a case where the answer to the clue "... heartlessly denoted..." is "deed". As an example of "homophones", there is a case where the answer to the clue "... aisle ... I hear" is "isle".

**[0009]** As described above, the cryptic crossword requires a player to not only solve the wordplay constituted of vertical and horizontal strings of words as found in the general crossword, but also solve the wordplay upon reading the clue. Therefore, the above-mentioned search devices cannot present only words having a high possibility of becoming the answer as search results, leading a problem that sufficient effects of assistance cannot be produced.

**[0010]** In contrast, studies have been made on a system for searching for the answer to the cryptic crossword by use of a general-purpose personal computer. There are a software program called "Crossword Maestro (trademark)" by William Tunstall-Pedoe ("Crossword Maestro (trademark) for Windows (registered trade-

mark): crossword solving software, cryptic crossword solver", (on line), (searched on 21st August 2007), Internet (URL: <http://www.crosswordmaestro.com/>)), a Web system that allows online use of the further improved software program of Crossword Maestro (see "Clue Solver, (on line), Genius 2000 Ltd., (searched on 21st August 2007), Internet (URL: <http://www.crossword-tools.com/cm/>)), and the like. Those systems operate by use of a general-purpose operating system (OS), and the creator says that those systems use an artificial intelligence technology, from which those systems are assumed to perform a high-level processing such as a search according to complicated conditions using a relatively large-scale database.

**[0011]** The above-mentioned search systems are assumed to be effective as a tool used when finding the answer to the cryptic crossword. However, in the current situations, not all clues can be solved. On the other hand, with such a function as to present a plurality of candidates having a relatively high possibility of becoming the answer, the above-mentioned systems may be practical options as a device for assisting the user's work of a word search. In other words, for example, when the user performs the work of solving the clue while consulting a dictionary and the like, it is assumed that there is demand for such a function as to present candidates for a word having a relatively high possibility of being correct. In that case, for example, it may be of significant importance to provide an electronic dictionary having a dictionary function with an additional function of assisting the finding of the answer to the cryptic crossword. However, none of the conventional devices having a small size such as the electronic dictionary are provided with the function of assisting the search for the answer to the cryptic crossword.

**[0012]** German laid-open patent application DE 4219585 describes an apparatus for solving crosswords, comprising an input device (e.g. a keyboard), a display, a search matrix and a search-control means, which in turn contains a comparator stage. A word store is also included. In use, the input device is used to enter one or more search terms into the search matrix. Some locations of the search matrix will be filled with letters that are already known, these being part of the required solution to a clue. The remaining letters of the required word are to be found by searching the word store. Locations of the search matrix, which do not contain letters, are ignored. It can be specified, via the input device, how many letters the required word has. The matrix also includes a specification location, which consists of a series of attributes. These attributes may indicate whether or not the required word is, e.g., a geographical term, or a person or a thing; whether it is an adjective or a verb; whether it is masculine or feminine or a plural term. The user can enter into this specification location the value "1" for the relevant attributes. The attributes of the specification location of the search matrix correspond to the non-cryptic "dues" of the crossword.

**[0013]** The present invention has been made in view

of the above-mentioned circumstances, and an object thereof is to provide a word search device which has a simple structure suitable when provided to a small-size device such as an electronic dictionary and can assist the work of searching for the answer to a cryptic crossword, and a method and program therefor.

**[0014]** In order to solve the above-mentioned problems, in a first aspect of the present invention a word search device includes the features defined in claim 1.

**[0015]** A second aspect of the present invention further includes condition storage means for storing a correspondence between a specific character string and the predetermined condition, in which if the specific character string corresponding to the predetermined condition judged to be satisfied by the conditional word comparison means is contained in the clue, the display means displays to that effect.

**[0016]** In a third aspect of the present invention, the predetermined condition includes a condition that the word retrieved by the word search means and the character string composing the clue have a relationship of anagrams. In a fourth aspect of the present invention, the predetermined condition includes a condition that the word retrieved by the word search means and the character string composing the clue have a relationship of being reversal to each other.

**[0017]** In a fifth aspect of the present invention, the predetermined condition includes a condition that the word retrieved by the word search means extends across two or more words within the clue. In a sixth aspect of the present invention, the predetermined condition includes conditions that the word retrieved by the word search means is equal to one word that is contained in the clue and has the characters partially deleted. In a seventh aspect of the present invention, the predetermined condition includes conditions that the word retrieved by the word search means is equal to one word that is contained in the clue and has the characters partially deleted, and that the character string including the deleted characters corresponds to a word contained in the word list stored in the word storage means. In an eighth aspect of the present invention, the predetermined condition includes a condition that the word retrieved by the word search means has a relationship of homophones having different spellings from the word contained in the clue.

**[0018]** In a tenth aspect of the present invention a word search method includes the steps set forth in claim 4.

**[0019]** An eleventh aspect of the present invention provides a word search program as defined in claim 6.

**[0020]** According to an aspect of the present invention, the word retrieved by the word search means and the character string composing the clue are compared with each other to judge whether or not the predetermined condition is satisfied, and the word judged to satisfy the predetermined condition is displayed based on classification according to the predetermined condition. Accordingly, there is no need to perform, for example, a proba-

bility calculation or the like, and only the judgment as to whether or not the predetermined condition is satisfied has to be performed, which makes it possible to simplify the configuration for the search with ease. In addition, the retrieved candidates for the word to be the correct answer are presented based on classification according to the condition in such an easy-to-view manner that efficient assistance can be performed.

**[0021]** Further, according to another aspect of the present invention, the word search device further includes the condition storage means for storing a correspondence between a specific character string and the predetermined condition, and in which if the specific character string corresponding to the predetermined condition judged to be satisfied by the conditional word comparison means is contained in the clue, the display means displays to that effect. Accordingly, the user can easily know which character string within the clue the condition is set based on.

**[0022]** Further, according to still another aspect of the present invention, the word search means searches the word storage means for a word that has the number of characters of the answer word by sorting characters of a character string, which is obtained by eliminating a symbol representing a boundary between words from the character string composing the clue, in a predetermined order, and then comparing the character string having the characters sorted with each word contained in the word list stored in the word storage means. Accordingly, if the clue includes a plurality of words and the character such as a space representing the boundary between words, it is possible to search the word list including a plurality of words with efficiency.

**[0023]** Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

FIG. 1 is a block diagram showing a word search device according to an embodiment of the present invention;

FIG. 2 is a diagram showing an example of storage contents of word list storage means (41) shown in FIG. 1;

FIG. 3A is a diagram showing a display example of a display device (30) shown in FIG. 1;

FIG. 3B is a diagram showing an example of the storage contents of the word list storage means (41) shown in FIG. 1;

FIG. 3C is a diagram showing an example of storage contents of indicator storage means (42) shown in FIG. 1;

FIG. 4 is a flowchart for explaining an operation of word search means (12) shown in FIG. 1;

FIGS. 5A to 5F are explanatory diagrams for explaining the operation of the word search means (12) shown in FIG. 1;

FIG. 6 is a flowchart for explaining an operation (in a case of "bridge") of conditional word comparison

means (14) shown in FIG. 1;

FIGS. 7A to 7C are explanatory diagrams for explaining the operation (in the case of "bridge") of the conditional word comparison means (14) shown in FIG. 1;

FIG. 8 is a diagram showing a display example of the display device (30) shown in FIG. 1;

FIG. 9 is a flowchart for explaining the operation (in a case of "anagram") of the conditional word comparison means (14) shown in FIG. 1;

FIGS. 10A to 10G are explanatory diagrams for explaining the operation (in the case of "anagram") of the conditional word comparison means (14) shown in FIG. 1;

FIG. 11 is a diagram showing another display example of the display device (30) shown in FIG. 1;

FIG. 12 is a flowchart for explaining the operation (in cases of "deletion" and "burial") of the conditional word comparison means (14) shown in FIG. 1;

FIGS. 13A to 13D are explanatory diagrams for explaining the operation (in the cases of "deletion" and "burial") of the conditional word comparison means (14) shown in FIG. 1;

FIGS. 14A and 14B are other explanatory diagrams for explaining the operation (in the cases of "deletion" and "burial") of the conditional word comparison means (14) shown in FIG. 1;

FIG. 15 is a flowchart for explaining the operation (in a case of "reversal") of the conditional word comparison means (14) shown in FIG. 1;

FIG. 16 is an explanatory diagram for explaining the operation (in the case of "reversal") of the conditional word comparison means (14) shown in FIG. 1;

FIG. 17 is a flowchart for explaining the operation (in a case of "homophones") of the conditional word comparison means (14) shown in FIG. 1; and

FIG. 18 is an explanatory diagram for explaining the operation (in the case of "homophones") of the conditional word comparison means (14) shown in FIG. 1.

**[0024]** Hereinafter, an embodiment of the present invention will be described by referring to the drawings. FIG. 1 is a block diagram showing a word search device according to the embodiment of the present invention. A word search device 1 shown in FIG. 1 is configured, for example, as a portable-type electronic dictionary having a function of searching a plurality of dictionaries including English-English, English-Japanese, and Japanese-English dictionaries, and a function of presenting candidates for a word forming the answer to a cryptic crossword by which the present invention is characterized.

**[0025]** The word search device 1 includes a control unit 10, a character input device 20, a display device 30, and a storage unit 40. The control unit 10 is constituted of a central processing unit (CPU), a random access memory (RAM), a read-only memory (ROM), a rewritable non-volatile memory, various interface circuits, and

the like, and controls each of the components by the CPU executing a program stored in the ROM. The block diagram of FIG. 1 shows that the control unit 10 includes input data temporary storage means 11, word search means 12, word list search result storage means 13, conditional word comparison means 14, display means 15, and indicator detection means 16, which are implemented under control of the internal component such as the CPU, and are software and hardware components for performing processings by which the present invention is characterized.

**[0026]** The storage unit 40 is constituted of a ROM and the like, and includes word list storage means 41 for storing a word list containing a plurality of words and indicator storage means 42 for storing correspondences between specific character strings used as indicators and the types of indicator. As shown in FIG. 2, the word list stored in the word list storage means 41 is structured by listing a plurality of English words sorted by the number of letters. In the example of FIG. 2, a plurality of words are registered in the word list such that three-letter English words sorted in alphabetical order are listed at the top, and that four-letter English words sorted in alphabetical order are listed next. In addition, the last word of a word set corresponding to each number of letters is set to a predetermined symbol representing the last character for the number of letters. Further, within the word list, words called homophones, which are different in spelling, have information indicating their correspondence appended thereto. In the example of FIG. 2, the information indicating that the words "aisle" and "isle" are homophones having different spellings from each other is appended to each of the words.

**[0027]** Note that the storage unit 40 also stores various dictionary files for an English-English dictionary, an English-Japanese dictionary, a Japanese-English dictionary, and a Japanese language dictionary.

**[0028]** FIG. 3C shows an example of storage contents of the indicator storage means 42. The character string including one or a plurality of words on the left side of the colon in each line is the specific character string used as the indicator, while the character string on the right side of the colon indicates the type of indicator to which the indicator on the left side belongs - in other words, the condition indicated by the indicator. This example shows that the indicator storage means 42 stores: the words "in" and "inside" as indicators classified under the types "bridge" and "burial"; the word "around" as an indicator classified under the type "burial"; the words "awkwardly", "badly", and "mashed" as indicators classified under the type "anagram"; the words "absence", "beheaded", and "empty" as the indicators classified under the type "deletion"; the compounds "sound like" and "I hear" as indicators classified under the type "homophones"; and the words "backwards", "mirror", and "reversing" as indicators classified under the type "reversal".

**[0029]** Note that the indicator is a character string that represents a particular wordplay-related condition, the

condition being between a word forming an answer and a character string constituting a clue. Accordingly, the correspondence between the specific character string to be the indicator and the type of indicator, which is stored in the indicator storage means 42, can be grasped as indicating a correspondence between the specific character string and the wordplay-related condition involved between the word forming the answer and the character string constituting the clue.

**[0030]** Next, the input data temporary storage means 11 of FIG. 1 is constituted of a RAM and the like, and stores character data inputted through the character input device 20, results of detection performed by the indicator detection means 16, and the like. The character input device 20 is configured by including a plurality of operation elements such as alphabet input keys, numeral input keys, a space input key, a cursor key, an enter key, various function keys, and a power key. Operation information on each operation element is temporarily stored in the input data temporary storage means 11, and then sent to the word search means 12 and the like. For example, if there is an input of the character string representing a clue to a cryptic crossword and the number of characters of a word forming the answer, the inputted information is temporarily stored in the input data temporary storage means 11, and then sent to the word search means 12, by which a search is performed based on the inputted information.

**[0031]** From the word list stored in the word list storage means 41 within the storage unit 40, the word search means 12 retrieves all words that have the number of characters of the answer word and can be generated from a plurality of characters contained in the character string composing the clue, and stores the retrieved words in the word list search result storage means 13.

**[0032]** The conditional word comparison means 14 compares the words retrieved by the word search means 12 with the character string composing the clue to judge whether or not a predetermined condition is satisfied. The predetermined condition represents a constraint corresponding to the wordplay put into the clue to the cryptic crossword, and examples thereof include: the word retrieved from the word list and the character string composing the clue having a relationship of being anagrams (corresponding to the type of indicator "anagram"); those having a relationship of being a reversal of each other (corresponding to "reversal"); the retrieved word extending across two or more words within the clue (corresponding to "bridge"); the retrieved word being equal to one partially-deleted word contained in the clue (corresponding to "deletion"); the one partially-deleted word having deleted characters composing a character string representing another word (corresponding to "burial"); and the retrieved word and the word contained in the clue having a relationship of being homophones having different spellings from each other (corresponding to "homophones"). In this embodiment, the conditional word comparison means 14 is configured to execute a judgment

processing for each condition by a separate subroutine.

**[0033]** The display means 15 controls the display device 30 to display the words judged to satisfy the predetermined condition by the conditional word comparison means 14, based on classification according to the corresponding condition, that is, the type of indicator.

**[0034]** Optionally, the indicator detection means 16 may also refer to the indicator storage means 42 to judge whether or not the clue contains the specific character string corresponding to the predetermined condition judged to be satisfied by the conditional word comparison means 14, and if positive, the indicator detection means 16 displays to that effect on the display device 30 via the display means 15.

**[0035]** Further, the display device 30 is constituted of a liquid crystal display and the like, and controlled by the display means 15 to display image information such as a character and a graphical shape.

**[0036]** Next, description will be made of a processing performed by the word search means 12 of FIG. 1 with reference to FIGS. 3A to 5F. FIG. 3A is a diagram showing an example in which the inputted clue is displayed on the display device 30, FIG. 3B is a diagram showing a related part of the storage contents of the word list storage means 41, and FIG. 3C is a diagram showing the storage contents of the indicator storage means 42. FIG. 4 is a flowchart showing a flow of the processing performed by the word search means 12. FIGS. 5A to 5F show examples of character information processed in the key steps of FIG. 4.

**[0037]** In this case, after the clue to the cryptic crossword "Shudder in great remorse." shown in FIG. 5A and the designated number of characters "6" of the word forming the answer given to the clue are inputted by the character input device 20, the inputted information is stored in the input data temporary storage means 11, and the clue is displayed on the display device 30 as shown in FIG. 3A. If a predetermined operation element for instructing an answer search processing, which is included in the character input device 20, is operated, the word search means 12 accesses the input data temporary storage means 11 to create a character string obtained by eliminating a symbol ("space" in this embodiment) representing the boundary between words from the character string composing the inputted clue (hereinafter, referred to as "input character string") and coupling the inputted words (Step S11 of FIG. 4). FIG. 5B shows an example of the created character string.

**[0038]** Subsequently, the word search means 12 sorts the letters composing the created character string in alphabetical order (Step S12). FIG. 5C shows an example of the character string after the sorting. Then, based on the designated number of characters of the answer word, the word search means 12 determines where to jump into the word list stored in the word list storage means 41 (Step S13). In this case, the designated number of characters is "6", so the head word "abacus" of the word set corresponding to the number of letters "6" shown in

FIG. 2 is determined as a jump destination of the word list, that is, the first word to be searched.

**[0039]** The word search means 12 reads the word "abacus" set as the jump destination by the word list storage means 41 (Step S14). Note that in Step S14, after reading the word, the word search means 12 performs a processing of setting a word placed at the subsequent position of the word list as the next word to be read.

**[0040]** Subsequently, the word search means 12 judges whether or not the read word is the last word of the word set corresponding to the same number of characters (in this case, the number of letters "6") (Step S15). In this case, the read word "abacus" is not the last word ("No" in Step S15), so the word search means 12 performs a processing of sorting the letters composing the read word character string "abacus" in alphabetical order (Step S16). In this case, the word "abacus" has the letters sorted into "aabcsu".

**[0041]** The word search means 12 then judges whether or not the letters of the word character string (in this case, "aabcsu") sorted in Step S16 are contained in the input character string (FIG. 5C) having the letters sorted in Step S12 (Step S17). In this case, the word character string is not contained ("No" in Step S17), so the procedure returns to Step S14, where the next word (in this case, the word "abanet" shown in FIG. 2) is read from the word list of the word list storage means 41. After that, the processing of Steps S14 to S17 is repeatedly executed.

**[0042]** It is now assumed that in Step S14, the underlined word "tremor" of the word set corresponding to the number of letters "6" shown in FIG. 3B is read. FIG. 5D shows the read word. Then, in Step S15, the read word is judged not to be the last word of the word set corresponding to the number of letters "6" (the judgment results in "No"), so the procedure advances to Step S16, where the letters of the read word character string are sorted in alphabetical order. FIG. 5E shows the character string having the letters sorted. It is then judged whether or not the sorted letters of the word character string are contained in the input character string (Step S17). In this case, as indicated in FIG. 5F as white letters on black, the letters of the character string shown in FIG. 5E are contained in the character string obtained by sorting the letters of the character string of the clue in alphabetical order ("Yes" in Step S17), so the procedure advances to Step S18, where the word ("tremor") that corresponds to the number of characters of the answer word and can be generated from a plurality of letters contained in the character string composing the clue is stored in the word list search result storage means 13 of FIG. 1.

**[0043]** Then, the procedure returns to Step S14, and after that, the processing of Steps S14 to S17 or the processing including Step S18 in addition to Steps S14 to S17 is repeatedly executed until the last word of the word set corresponding to the number of letters "6" of the word list has been processed. If the last word has already been read, it is judged in Step S15 that the last

word has been passed ("Yes" in Step S15), which brings the procedure to an end. Note that at the end of the processing, the word list search result storage means 13 has the list of words stored therein with a predetermined symbol representing the last character at the end.

**[0044]** As a result of the above-mentioned processing, all of the words that are contained in the word list and can be generated by extracting the characters having the set number of characters from the plurality of characters composing the character string of the clue are stored in the word list search result storage means 13.

**[0045]** Next, with reference to FIGS. 6 to 7C, description will be made of a case where the conditional word comparison means 14 performs a processing of judging whether or not the word retrieved by the word search means 12 extends across two or more words within the clue, that is, a conditional judgment processing corresponding to the type of indicator "bridge". FIG. 6 is a flowchart showing a flow of the processing in the case of performing the conditional judgment processing corresponding to "bridge", and FIGS. 7A to 7C are explanatory diagrams for explaining the processing contents of the key steps of FIG. 6, showing a relationship between the character string of the inputted clue to be compared and the word character string retrieved from the word list.

**[0046]** In this example, as has already been described above, the word search means 12 has performed a search through the word list within the word list storage means 41 with the clue shown in FIG. 5A and the designated number of letters "6" as the input data, and the word "tremor" and the symbol representing the end of words (assumed to be stored as one word similarly to the other words) are stored in the word list search result storage means 13.

**[0047]** First, the conditional word comparison means 14 retrieves one word from among the words stored in the word list search result storage means 13 (Step S101). In this case, the word "tremor" is retrieved.

**[0048]** Then, the conditional word comparison means 14 judges whether or not the retrieved word is the last "word" (Step S102), recalling that the last "word" in the list is the symbol representing the end of words. In this case, the word "tremor" is not the last word ("No" in Step S102), so the procedure advances to Step S103, where a variable N is initialized to "0".

**[0049]** Subsequently, the conditional word comparison means 14 performs a processing of setting a pointer to the Nth character from the head of the original input character string of the clue stored in the input data temporary storage means 11, and further setting another pointer to the head character of the word retrieved from the word list search result storage means 13 (hereinafter, referred to simply as "retrieved word") (Step S104). In this case, the clue reads "Shudder in great remorse.", and the original input character string is a 24-letter character string including spaces as shown in FIG. 7A as the input data. Note that the spaces are used as the symbol representing the boundary between words, and the period mark "." at

the end of the clue is deleted. In this processing, the 0th character of the input character string is defined as the head letter "S", the 1st character as the following letter "h", ..., the 15th character as the letter "t", the 16th character as the symbol "space", and the like.

**[0050]** Subsequently, the conditional word comparison means 14 compares the character to which the pointer is set for the input character string with the character to which the pointer is set for the retrieved word, and judges whether or not the characters match each other (Step S105). In this case, the pointer for the input character string is "0", and the pointer for the retrieved word is set to the head character. Therefore, the letters "S" and "t" are compared as shown in FIG. 7A, with the result that the letters do not match each other ("No" in Step S105), so the variable N is incremented by 1 (Step S106). In this case, the variable N becomes "1".

**[0051]** Then, the procedure returns to Step S104, where the conditional word comparison means 14 sets the pointer to the "1"st letter "h" of the input character string, and further sets another pointer to the head letter "t" of the retrieved word. Subsequently, it is judged in Step S105 whether or not the letters "h" and "t" to which the two pointers are set match each other (FIG. 7B), and because the letters do not match each other, the procedure advances to Step S106, where the variable N is incremented by 1, resulting in "N=2".

**[0052]** After that, Steps S104 to S106 are repeatedly executed in a similar manner, during which the variable N is set to "15" in Step S106. In this case, in Step S104, the conditional word comparison means 14 sets the pointer to the "15"th letter "t" of the input character string, and further sets the another pointer to the head letter "t" of the retrieved word. It is then judged in Step S105 whether or not the letters "t" and "t" to which the two pointers are set match each other (FIG. 7C), and because the letters match each other ("Yes" in Step S105), the procedure advances to Step S107, where the two pointers for the original input character string stored in the input data temporary storage means 11 and the retrieved word are moved forward by one character. In this case, the pointers are moved forward to the positions of the symbol "space" following the letter "t" of the input character string and of the letter "r" following the letter "t" of the retrieved word.

**[0053]** It is then judged in Step S108 whether or not the character indicated by the pointer for the retrieved word was next to the last character. In this case, the pointer has not passed the last character ("No" in Step S108), so it is judged in Step S110 whether or not the pointer character for the input character string is a space. In this case, the character at the position indicated by the pointer for the input character string is a space ("Yes" in Step S110), so the pointer for the input character string is moved forward by one character (Step S111). In this case, the pointer is moved forward to the position of the letter "r" following the space.

**[0054]** Subsequently, the conditional word comparison

means 14 judges whether or not the last character has been passed in the input character string (Step S112). In this case, the last character has not been passed ("No" in Step S112), so the procedure returns to Step S110, where it is judged whether or not the pointer character for the input character string is a space. In this case, because the pointer character is not a space, it is judged in Step S105 whether or not the characters indicated by the two pointers match each other. In this case, the characters indicated by the two pointers are both the letter "r" ("Yes" in Step S105), so the processing advances to Step S107, where the two pointers are moved forward by one character. At this point, the characters indicated by the two pointers both become "e".

**[0055]** After that, the processings of Steps S108, S110, S105, and S107 are repeatedly executed, during which the two pointers are set to the positions of the letter "r" just before Step S107. In this case, after Step 107, the pointer for the retrieved word has passed the last letter "r", so the judgment of Step S108 results in "Yes", and the retrieved word "tremor" is registered in a predetermined storage area as a word corresponding to "bridge" (Step S109).

**[0056]** Then, the procedure returns to Step S101, where the next one word is retrieved from the word list search result storage means 13, and the procedure advances to Step S102, where it is judged whether or not the retrieved word is the last "word". In this case, the symbol representing the last "word" is retrieved as the word in Step S101, so the judgment of Step S102 results in "Yes", which brings the procedure to an end. In other words, the last actual word in the list has already been passed and processed and the procedure comes to an end.

**[0057]** At this time, the conditional word comparison means 14 instructs the display means 15 to display the comparison results. For example, as shown in FIG. 8, the display means 15 controls the display device 30 to display thereon a box 31 for displaying the clue and a sheet 32 including a plurality of pages that are identified by tabs labeled with character strings (such as "Bridge" and "Deletion") representing the respective types of indicator. Displayed on each page are the words retrieved from the word list based on classification according to the type of indicator. In the example of FIG. 8, the clue "Shudder in great remorse." is displayed in the box 31, while the word "tremor" that satisfies the condition corresponding to "bridge" is displayed on the page identified by the tab labeled "Bridge". In addition, for the character string of the clue displayed in the box 31, the word "in" registered as the indicator is highlighted by underline, and the character string "t remor" corresponding to the word "tremor" retrieved as a candidate for the answer is highlighted as white letters on black.

**[0058]** Note that the processing of specifying the character string registered as the indicator from the clue is performed by the indicator detection means 16 of FIG. 1. The indicator detection means 16 compares the input

character string inputted as the clue stored in the input data temporary storage means 11 and the character string (such as "in" and "inside") registered as the indicator in the indicator storage means 42 as shown in FIG. 3C to thereby judge whether or not the input character string contains the character string registered as the indicator, and if positive, the processing for identifying and highlighting the character string is performed.

**[0059]** Accordingly, the character string corresponding to the indicator which is contained in the clue is highlighted, and at the same time, the words contained in the predetermined word list each of which has a predetermined correspondence with the character string composing the clue are displayed according to the type of correspondence. Thus, the words to be the candidates for the answer can be presented to a user along with information indicating the reasons for their extraction. At this time, according to the configuration of this embodiment, the above-mentioned word to be the candidate for the answer is determined by the search through the word list including a plurality of words and the judgment of the correspondence between the word obtained as a result of the search and the character string composing the clue. Therefore, there is no need to perform a complicated search processing or such a processing as to analyze, for example, the meaning of a word or a compound or the meaning of the clue. Further, the obtained results are displayed based on classification according to the type of indicator, which is more advantageous than a case without the classification in that the user can easily check if the answer is right or wrong.

**[0060]** Note that the display method for the display device 30 is not limited to the above-mentioned method, and may be replaced by one or a combination of methods of changing a display color for the character, causing the cursor or character to blink, rearranging the types of indicator, and the like.

**[0061]** Next, with reference to FIGS. 9 to 10G, description will be made of a case where the conditional word comparison means 14 performs a processing of judging whether or not the word retrieved by the word search means 12 has the relationship of being an anagram of the character string composing the clue, that is, the conditional judgment processing corresponding to the type of indicator "anagram". FIG. 9 is a flowchart showing a flow of the processing in the case of performing the conditional judgment processing corresponding to "anagram", and FIGS. 10A to 10G are explanatory diagrams showing the contents of data processed in the key steps of FIG. 9. Note that the words obtained as a result of the search through the word list by the word search means 12 based on the inputted clue and the number of characters have already been registered in the word list search result storage means 13.

**[0062]** The conditional word comparison means 14 first reads the input character string of the clue from the input data temporary storage means 11, eliminates the space, and couples the words to each other (Step S201). For

example, if the input character string is "Mashed pears may be used offensively." as shown in FIG. 10A, the coupling results in "mashedpearsmaybeusedoffensively" as shown in FIG. 10B. Note that the designated number of characters for the answer in this example is assumed "5".

**[0063]** Then, the conditional word comparison means 14 performs a processing of sorting the letters of the character string obtained by coupling the inputted words in alphabetical order, and, at the same time, storing information on the original position of each character (Step S202). In the above-mentioned example, the sorting in alphabetical order results in "aabdfefeeeeehilmoprsss-suvy" as shown in FIG. 10C. Note that when the information on the original position of each character is stored, information on the original position of the space serving as the character to be the boundary between words is stored as well.

**[0064]** Subsequently, the conditional word comparison means 14 retrieves one word from the word list search result storage means 13 (Step S203), and judges whether or not the word is the last word (Step S204). In this case, the word "spear" shown in FIG. 10D is retrieved.

**[0065]** Subsequently, the conditional word comparison means 14 sorts the letters of the character string of the retrieved word in alphabetical order (Step S205). The sorting of the word "spear" results in "aeprs" as shown in FIG. 10E.

**[0066]** Then, by comparing the character strings having the letters sorted in alphabetical order, the conditional word comparison means 14 judges whether or not the retrieved word is contained in the input character string (Step S206). In this case, because the retrieved word is contained in the input character string as shown in FIG. 10F, the conditional word comparison means 14 then checks whether or not a word-basis match occurs in all of the characters commonly contained in the two character strings match therebetween based on the information on the original position of each character (Step S207). That is, it is confirmed whether or not the types of characters composing the retrieved word and the number of characters for each type match the types of characters composing any one of words contained in the input character string and the number of characters for each type, respectively. In this example, the word-basis match is confirmed because, as shown in FIG. 10G, the retrieved word "spear" matches the word "pears" within the input character string in that the characters composing the words have five types, "a", "e", "p", "r", and "s", and that the numbers of characters for the respective types are all one.

**[0067]** Subsequently, the conditional word comparison means 14 judges whether or not the word-basis match has been confirmed in all of the characters (Step S208), and if confirmed, registers the retrieved word as "anagram" (Step S209). In this example, the word-basis match is judged to have been confirmed, so the retrieved word "spear" is registered as "anagram".

**[0068]** Then, the procedure returns to Step S203, and

a part or all of the processings of Steps S203 to S209 are repeatedly executed until it is judged in Step S204 that the last word has been reached.

**[0069]** Accordingly, the word registered by the conditional word comparison means 14 is displayed, for example, as shown in FIG. 11. In this example, the clue "Mashed pears may be used offensively." is displayed in the box 31, while the word "spear" is displayed on the page identified by the tab labeled "anagram". Note that the indicator "Mashed" detected as the type "anagram" by the indicator detection means 16 is displayed with an underline.

**[0070]** Next, with reference to FIGS. 12 to 14B, description will be made of a case where the conditional word comparison means 14 performs a processing of judging whether or not the word retrieved by the word search means 12 is equal to one word that is contained in the clue and has the characters partially deleted and whether or not the retrieved word is equal to one word that is contained in the clue and has the characters partially deleted and at the same time the character string including the deleted characters corresponds to a word contained in the word list, that is, the conditional judgment processing corresponding to the types of indicator "deletion" and "burial".

**[0071]** FIG. 12 is a flowchart showing a flow of the processing in the case of performing the conditional judgment processing corresponding to "deletion" and "burial", and FIGS. 13A to 14B are explanatory diagrams showing the processing contents of the key steps of FIG. 12, showing the relationship between the character string of the inputted clue to be compared and the word character string retrieved from the word list.

**[0072]** FIGS. 13A to 13D show a relationship between the character strings in a case of performing a processing of judging whether or not the retrieved word "tremor" satisfies the condition for the clue "Shudder in great remorse.". FIG. 13A shows a state in which the character string starting from the 0th character of the clue is compared with the retrieved word, and FIGS. 13B to 13D show states in which the character strings starting from the 8th, 11th, and 17th characters of the clue are compared with the retrieved word, respectively. In this example, none of the conditions "deletion" and "burial" are satisfied.

**[0073]** FIG. 14A shows a relationship between the character strings in a case of performing a processing of judging whether or not the retrieved word "bole" satisfies the condition for the clue "Tree grows from empty bottle." FIG. 14A shows a state in which the character string starting from the 22nd character of the clue is compared with the retrieved word. In this example, the word "bottle" within the clue contains the retrieved word "bole", which establishes the condition corresponding to "deletion".

**[0074]** FIG. 14B shows a relationship between the character strings in a case of performing a processing of judging whether or not the retrieved word "deed" satisfies the condition for the clue "Heartlessly denoted an act.".

FIG. 14B shows a state in which the character string starting from the 12th character of the clue is compared with the retrieved word. In this example, the word "denoted" within the clue contains the retrieved word "deed", and, at the same time, the character string "not" obtained by eliminating "deed" from "denoted" represents a word registered in the word list, which establishes the condition corresponding to "burial".

**[0075]** Hereinafter, description will be made of the flowchart of FIG. 12. The conditional word comparison means 14 first retrieves one word from the word list search result storage means 13 (Step S301), judges whether or not the retrieved word is the last word (Step S302), and if the retrieved word is the last word ("Yes" in Step S302), brings the processing to an end. If the retrieved word is not the last word ("No" in Step S302), the conditional word comparison means 14 initializes the variable N to "0" (Step S303), and sets a pointer to the Nth character from the head of the original input character string stored in the input data temporary storage means 11 and another pointer to the head character of the retrieved word (Step S304).

**[0076]** Subsequently, the conditional word comparison means 14 judges whether or not the Nth character of the input character string is a space (Step S305). If the Nth character is a space ("Yes" in Step S305), the variable N is incremented so as to move the pointer to the head character of the next word within the input character string (Step S308). If the last word has not been passed in the input character string when the variable N is incremented so as to move the pointer ("No" in Step S309), the procedure returns to Step S304, where the pointer is set to the next word within the input character string.

**[0077]** On the other hand, if it is judged in Step S305 that the Nth character is not a space ("No" in Step S305), it is judged whether or not the characters indicated by the two pointers match each other (Step S306). If the characters do not match each other ("No" in Step S306), the pointer for the input character string is moved forward by 1 character (Step S307), and the procedure returns to Step S305 to perform the subsequent steps. If the characters match each other ("Yes" in Step S306), the two pointers for the original input character string of the input data temporary storage means 11 and for the retrieved word are moved forward by 1 character (Step S310).

**[0078]** Subsequently, in Step S311 the conditional word comparison means 14 judges whether or not the last character has been passed in the retrieved word, and if the last character has not been passed ("No" in Step S311), judges whether or not the character designated by the pointer for the input character string is a space (Step S312). If the character is a space, the procedure returns to Step S308, and if the character is not a space, the procedure returns to Step S306.

**[0079]** On the other hand, if it is judged in Step S311 that the last character has been passed in the retrieved word ("Yes" in Step S311), the retrieved word is contained in any one of words within the input character

string, so the retrieved word is registered as a word corresponding to "deletion" (Step S313).

**[0080]** Subsequently, the conditional word comparison means 14 obtains the character string by joining the remaining characters of the matched input character string word to search the word list for the obtained character string (Step S314), and if the obtained character string is found ("Yes" in Step S315), registers the retrieved word as a word corresponding to "burial" (Step S316).

**[0081]** If it is judged in Step S309 that the last word has been passed in the input character string ("Yes" in Step S309), if the obtained character string is not found in Step S315 ("No" in Step S315), and if the retrieved word is registered as "burial" (Step S316), the procedure returns to Step S301, where one word is retrieved from the word list search result storage means 13 to execute the processing of Step S302 and the subsequent steps.

**[0082]** Next, with reference to FIGS. 15 and 16, description will be made of a case where the conditional word comparison means 14 performs a processing of judging whether or not the word retrieved by the word search means 12 has the relationship of being a reversal with respect to the character string composing the clue, that is, the conditional judgment processing corresponding to the type of indicator "reversal".

**[0083]** The conditional word comparison means 14 first retrieves one word from the word list search result storage means 13, and reverses the order of characters composing the retrieved character string to obtain a new retrieved word (Step S401). After judging whether or not the retrieved word is the last word, if the retrieved word is the last word ("Yes" in Step S402), the conditional word comparison means 14 brings the processing to an end. If the retrieved word is not the last word ("No" in Step S402), the conditional word comparison means 14 initializes the variable N to "0" (Step S403), and sets a pointer to the Nth character from the head of the original input character string stored in the input data temporary storage means 11 and another pointer to the head character of the retrieved word (reversed word) (Step S404).

**[0084]** Then, the conditional word comparison means 14 compares the word starting from the Nth character of the input character string with the retrieved word to judge whether or not the words match each other (Step S405). If the words match each other ("Yes" in Step S405), the retrieved word is registered as "reversal" (Step S406). If the words do not match each other ("No" in Step S405), the variable N is incremented so as to move the pointer to the head character of the next word within the input character string (Step S407), and after that, it is judged whether or not the last word has been passed in the input character string (Step S408).

**[0085]** If the last word has been passed ("Yes" in Step S408), the procedure returns to Step S401, where a new word is retrieved to execute the processing of Step S402 and the subsequent steps. If the last word has not been passed ("No" in Step S408), the procedure returns to Step S404 to execute the processing of Step S404 and

the subsequent steps on the next word within the input character string and the same retrieved word used so far.

**[0086]** FIG. 16 is a diagram for explaining a processing of comparing the clue "Halt reversing pots." with the retrieved word "stop" obtained by reversing the word "pots" stored in the word list search result storage means 13, showing a relationship in a case where the variable N is set to 15. In this example, the word "pots" within the clue and the retrieved word "stop" have the relationship corresponding to "reversal".

**[0087]** Next, with reference to FIGS. 17 and 18, description will be made of a case where the conditional word comparison means 14 performs a processing of judging whether or not the word retrieved by the word search means 12 has the relationship of being a homophone having a different spelling with respect to the character string composing the clue, that is, the conditional judgment processing corresponding to the type of indicator "homophones".

**[0088]** The conditional word comparison means 14 first retrieves one word from the word list search result storage means 13 (Step S501). After judging whether or not the retrieved word is the last word, if the retrieved word is the last word ("Yes" in Step S502), the conditional word comparison means 14 brings the processing to an end. If the retrieved word is not the last word ("No" in Step S502), the conditional word comparison means 14 initializes the variable N to "0" (Step S503), and sets a pointer to the Nth character from the head of the original input character string stored in the input data temporary storage means 11 and another pointer to the head character of the retrieved word (Step S504).

**[0089]** Then, the conditional word comparison means 14 judges whether or not the word starting from the Nth character of the input character string has a homophone having a different spelling (Step S505).

**[0090]** If the input character string does not have a homophone having a different spelling ("No" in Step S505), the variable N is incremented so as to move the pointer to the head character of the next word within the input character string (Step S509), and it is judged whether or not the last word has been passed in the input character string (Step S510). If the last word has been passed ("Yes" in Step S510), the procedure returns to Step S501, where a new word is retrieved to execute the processing of Step S502 and the subsequent steps. If the last word has not been passed ("No" in Step S510), the procedure returns to Step S504 to execute the processing of Step S504 and the subsequent steps on the next word within the input character string and the same retrieved word used so far.

**[0091]** On the other hand, if the input character string has a homophone having a different spelling ("Yes" in Step S505), one or a plurality of homophones having different spellings with respect to the word starting from the Nth character of the input character string are acquired and stored in a work buffer (Step S506), and the words stored in the work buffer are compared with the

retrieved word to judge whether or not any one of the words matches the retrieved word (Step S507). If a match occurs ("Yes" in Step S507), the retrieved word is registered as "homophones" (Step S508). If no match occurs ("No" in Step S507), the procedure advances to Step S509 to execute the above-mentioned processing of Step S509 and the subsequent steps.

**[0092]** FIG. 18 is a diagram for explaining a processing of comparing the homophone having a different spelling with respect to the word contained in the clue "Aisle which is surrounded by water I hear." with the word "isle" stored in the word list search result storage means 13. In this example, the homophone "isle" having a different spelling with respect to the word "Aisle" within the input character string matches the retrieved word "isle".

**[0093]** Note that the embodiment of the present invention is not limited to the above-mentioned configurations, and can appropriately be subjected to, for example, such modifications as to integrate or disperse some or all of the respective means within the control unit 10 and integrate some or all of the means with the storage means within the storage unit 40. Such configurations are also possible that communication lines and predetermined storage media are used to update the contents of files within the storage unit 40, and that the files within the storage unit 40 are arranged by being dispersed via the communication lines. Further, the word search device according to the present invention is not limited to the implementation as the electronic dictionary, and may be implemented by a general-purpose computer and a software program executed thereby. Further, the word search device according to the present invention can be implemented by a computer and peripherals and a program executed thereby, and the program can be distributed via communication lines or the computer-readable storage media. Alternatively, the present invention can be configured as a system implemented by using a plurality of computers connected via communication lines such as a Web system on the Internet or the like. Further, the language to be provided by the present invention is not limited to English, and may be another language that uses the alphabet such as German, French, or Spanish, or a language that does not use the alphabet such as Japanese.

**[0094]** An answer may include several words and references to "an answer word", "a word forming the answer" and the like in this specification are to be treated as references to one, some or all of the words in the answer.

**[0095]** The foregoing description has been given by way of example only and it will be appreciated by a person skilled in the art that modifications can be made without departing from the scope of the present invention.

## Claims

1. A word search device (1), comprising:

input means (20) for inputting a clue to a cryptic crossword and the number of characters of an answer word;

word storage means (41) for storing a word list containing a plurality of words;

word search means (12) for searching the word storage means (41) for a word that has the number of characters of the answer word and can be generated from a plurality of characters contained in a character string composing the clue;

conditional word comparison means (14) for comparing the word retrieved by the word search means with the character string composing the clue to judge whether or not a predetermined condition is satisfied; and

display means (15) for displaying the word judged to satisfy the predetermined condition by the conditional word comparison means based on classification according to the predetermined condition;

wherein the word search means (12) is arranged to search the word storage means for a word that has the number of characters of the answer word by sorting characters of a character string, which is obtained by eliminating a symbol representing a boundary between words from the character string composing the clue, in a predetermined order, and then to compare the character string having the characters sorted with each word having the number of characters of the answer word contained in the word list stored in the word storage means, and

wherein said word search means (12) is adapted to sort the characters of the word retrieved from the word storage means (41) in said predetermined order before comparing the sorted retrieved word with the sorted characters of the character string composing the clue.

2. A word search device according to claim 1, wherein:

said symbol is a space between words constituting the character string composing the clue; said predetermined order is an alphabetical order; and

said word search device comprises a search result storage means adapted to store the retrieved word, when a match is found between the sorted retrieved word and the sorted characters of the character string composing the clue.

3. A word search device according to claim 1, further comprising condition storage means for storing a correspondence between a specific character string and the predetermined condition, wherein if the specific character string corresponding

to the predetermined condition judged to be satisfied by the conditional word comparison means is contained in the clue, the display means displays to that effect.

4. A word search method, comprising:

an input step of inputting a clue to a cryptic crossword and the number of characters of an answer word;

a word search step of using word storage means for storing a word list containing a plurality of words to search the word storage means for a word that has the number of characters of the answer word and can be generated from a plurality of characters contained in a character string composing the clue;

a conditional word comparison step of comparing the word retrieved in the word search step with the character string composing the clue to judge whether or not a predetermined condition is satisfied; and

a display step of displaying the word judged to satisfy the predetermined condition in the conditional word comparison step based on classification according to the predetermined condition;

wherein the word search step searches the word storage means for a word that has the number of characters of the answer word by sorting characters of a character string, which is obtained by eliminating a symbol representing a boundary between words from the character string composing the clue, in a predetermined order, and the comparison step compares the character string having the characters sorted with each word having the number of characters of the answer word contained in the word list stored in the word storage means; and

wherein the word search step sorts the characters of the word retrieved from the word storage means (41) in said predetermined order, and the comparison step compares the sorted retrieved word with the sorted characters of the character string composing the clue.

5. A word search method according to claim 4, wherein:

said symbol is a space between words constituting the character string composing the clue; said predetermined order is an alphabetical order; and

the retrieved word is stored in a search result storage means, when a match is found between the sorted retrieved word and the sorted characters of the character string composing the clue.

6. A word search program, comprising a description for causing a computer to execute the method according to claim 4 or claim 5.

### Patentansprüche

1. Wörtersuchvorrichtung (1), umfassend:

ein Eingabemittel (20) zum Eingeben eines Schlüssels zu einem geheimen Kreuzworträtsel und der Anzahl von Zeichen eines Antwortwortes;

ein Wörterspeichermittel (41) zum Speichern einer Wörterliste, die mehrere Wörter enthält;

ein Wörtersuchmittel (12) zum Durchsuchen des Wörterspeichermittels (41) nach einem Wort, das die Anzahl von Zeichen des Antwortwortes aufweist und aus mehreren Zeichen erstellt werden kann, die in einer Zeichenfolge enthalten sind, aus der der Schlüssel zusammengesetzt ist;

ein bedingtes Wörtervergleichsmittel (14) zum Vergleichen des Wortes, das von dem Wörtersuchmittel abgefragt wurde, mit der Zeichenfolge, aus der der Schlüssel zusammengesetzt ist, zum Beurteilen, ob eine vorgegebene Bedingung erfüllt ist oder nicht; und

ein Anzeigemittel (15) zum Anzeigen des Wortes, das laut Urteil des bedingten Wörtervergleichsmittels die vorgegebene Bedingung erfüllt, auf der Basis einer Klassifikation gemäß der vorgegebenen Bedingung;

wobei das Wörtersuchmittel (12) so angeordnet ist, dass es das Wörterspeichermittel nach einem Wort durchsucht, das die Anzahl von Zeichen des Antwortwortes hat, indem es Zeichen einer Zeichenfolge, die durch Eliminieren eines Symbols erhalten wird, das eine Grenze zwischen Wörtern aus der Zeichenfolge darstellt, aus der der Schlüssel zusammengesetzt ist, in einer vorbestimmten Reihenfolge sortiert und dann die Zeichenfolge mit den sortierten Zeichen mit jedem Wort vergleicht, das die Anzahl von Zeichen des Antwortwortes aufweist, das in der Wörterliste enthalten ist, die in dem Wörterspeichermittel gespeichert ist, und

wobei das Wörtersuchmittel (12) dazu ausgebildet ist, die Zeichen des Wortes, das aus dem Wörterspeichermittel (41) abgefragt wird, in der vorgegebenen Reihenfolge zu sortieren, bevor das sortierte abgefragte Wort mit den sortierten Zeichen der Zeichenfolge verglichen wird, aus der der Schlüssel zusammengesetzt ist.

2. Wortsuchvorrichtung nach Anspruch 1, wobei:

das Symbol ein Leerraum zwischen Wörtern ist,

die die Zeichenfolge bilden, aus der der Schlüssel zusammengesetzt ist;

die vorgegebene Reihenfolge eine alphabetische Reihenfolge ist; und

die Wörtersuchvorrichtung ein Suchergebnisspeichermittel umfasst, das zum Speichern des abgefragten Wortes ausgebildet ist, wenn eine Übereinstimmung zwischen dem sortierten abgefragten Wort und den sortierten Zeichen der Zeichenfolge, aus der der Schlüssel zusammengesetzt ist, gefunden wird.

3. Wortsuchvorrichtung nach Anspruch 1 des Weiteren umfassend ein Bedingungsspeichermittel zum Speichern einer Entsprechung zwischen einer spezifischen Zeichenfolge und der vorgegebenen Bedingung,
- wobei, wenn die spezifische Zeichenfolge, die der vorgegebenen Bedingung entspricht, die laut Urteil des bedingten Wortvergleichsmittels erfüllt ist, in dem Schlüssel enthalten ist, das Anzeigemittel diese Tatsache anzeigt.

4. Wörtersuchverfahren, umfassend:

einen Eingabeschritt zum Eingeben eines Schlüssels zu einem geheimen Kreuzworträtsel und der Anzahl von Zeichen eines Antwortwortes;

einen Wörtersuchschritt zum Verwenden eines Wörterspeichermittels zum Speichern einer Wörterliste, die mehrere Wörter enthält, um das Wörterspeichermittel nach einem Wort zu durchsuchen, das die Anzahl von Zeichen des Antwortwortes aufweist und aus mehreren Zeichen erstellt werden kann, die in einer Zeichenfolge enthalten sind, aus der der Schlüssel zusammengesetzt ist;

einen bedingtes Wörtervergleichsschritt zum Vergleichen des Wortes, das im Wörtersuchschritt abgefragt wurde, mit der Zeichenfolge, aus der der Schlüssel zusammengesetzt ist, zum Beurteilen, ob eine vorgegebene Bedingung erfüllt ist oder nicht; und

einen Anzeigeschritt zum Anzeigen des Wortes, das laut Urteil im bedingten Wörtervergleichsschritt die vorgegebene Bedingung erfüllt, auf der Basis einer Klassifikation gemäß der vorgegebenen Bedingung;

wobei der Wörtersuchschritt das Wörterspeichermittel nach einem Wort durchsucht, das die Anzahl von Zeichen des Antwortwortes hat, indem er Zeichen einer Zeichenfolge, die durch Eliminieren eines Symbols erhalten wird, das eine Grenze zwischen Wörtern aus der Zeichenfolge darstellt, aus der der Schlüssel zusammengesetzt ist, in einer vorbestimmten Reihenfolge sortiert und dann die Zeichenfolge mit den

sortierten Zeichen mit jedem Wort vergleicht, das die Anzahl von Zeichen des Antwortwortes aufweist, das in der Wörterliste enthalten ist, die in dem Wörterspeichermittel gespeichert ist, und

wobei der Wörtersuchschritt die Zeichen des Wortes, das aus dem Wörterspeichermittel (41) abgefragt wird, in der vorgegebenen Reihenfolge sortiert und der Vergleichsschritt das sortierte abgefragte Wort mit den sortierten Zeichen der Zeichenfolge vergleicht, aus der der Schlüssel zusammengesetzt ist.

5. Wörtersuchverfahren nach Anspruch 4, wobei:

das Symbol ein Leerraum zwischen Wörtern ist, die die Zeichenfolge bilden, aus der der Schlüssel zusammengesetzt ist;  
die vorgegebene Reihenfolge eine alphabetische Reihenfolge ist; und  
das abgefragte Wort in einem Suchergebnisspeichermittel gespeichert wird, wenn eine Übereinstimmung zwischen dem sortierten abgefragten Wort und den sortierten Zeichen der Zeichenfolge, aus der der Schlüssel zusammengesetzt ist, gefunden wird.

6. Wörtersuchprogramm, umfassend eine Beschreibung, die einen Computer veranlasst, das Verfahren nach Anspruch 4 oder Anspruch 5 auszuführen.

### Revendications

1. Dispositif de recherche de mots (1), comprenant :

un moyen d'entrée (20) pour faire entrer un indice pour des mots croisés cryptiques et le nombre de caractères d'un mot de réponse ;  
un moyen de stockage de mots (41) pour stocker une liste de mots contenant une pluralité de mots ;

un moyen de recherche de mots (12) pour la recherche, dans le moyen de stockage de mots (41), d'un mot qui possède le nombre de caractères du mot de réponse et qui peut être généré à partir d'une pluralité de caractères contenus dans une chaîne de caractères composant l'indice ;

un moyen de comparaison de mots conditionnel (14) pour comparer le mot récupéré par le moyen de recherche de mots avec la chaîne de caractères composant l'indice afin d'évaluer si, oui ou non, une condition prédéterminée est satisfaite ; et

un moyen d'affichage (15) pour afficher le mot que l'on estime satisfaisant à la condition prédéterminée grâce au moyen de comparaison de

mots conditionnel sur la base d'une classification en fonction de la condition prédéterminée ; dans lequel le moyen de recherche de mots (12) est étudié pour effectuer une recherche, dans le moyen de stockage de mots, d'un mot ayant le nombre de caractères du mot de réponse en triant des caractères d'une chaîne de caractères, laquelle est obtenue en éliminant un symbole représentant une limite entre des mots de la chaîne de caractères composant l'indice, dans un ordre prédéterminé, et pour ensuite comparer la chaîne de caractères ayant les caractères triés avec chaque mot ayant le nombre de caractères du mot de réponse se trouvant dans la liste de mots stockée dans le moyen de stockage de mots, et

dans lequel ledit moyen de recherche de mots (12) est adapté pour trier les caractères du mot récupéré du moyen de stockage de mots (41) dans ledit ordre prédéterminé avant de comparer le mot récupéré trié avec les caractères triés de la chaîne de caractères composant l'indice.

2. Dispositif de recherche de mots selon la revendication 1, dans lequel :

ledit symbole est un espace entre mots constituant la chaîne de caractères composant l'indice ;

ledit ordre prédéterminé étant un ordre alphabétique ; et

ledit dispositif de recherche de mots comprenant un moyen de stockage de résultat de recherche adapté pour stocker le mot récupéré, lorsque l'on trouve une correspondance entre le mot récupéré trié et les caractères triés de la chaîne de caractères composant l'indice.

3. Dispositif de recherche de mots selon la revendication 1, comprenant par ailleurs un moyen de stockage de condition pour stocker une correspondance entre une chaîne de caractères spécifique et la condition prédéterminée,

dans lequel, si la chaîne de caractères spécifique correspondant à la condition prédéterminée que l'on estime satisfaite grâce au moyen de comparaison de mots conditionnel est contenue dans l'indice, le moyen d'affichage affiche à cet effet.

4. Procédé de recherche de mots, comprenant :

une étape d'entrée consistant à faire entrer un indice pour des mots croisés cryptiques et le nombre de caractères d'un mot de réponse ;

une étape de recherche de mots consistant à utiliser un moyen de stockage de mots pour stocker une liste de mots contenant une pluralité de mots pour la recherche, dans le moyen de

- stockage de mots, d'un mot qui possède le nombre de caractères du mot de réponse et qui peut être généré à partir d'une pluralité de caractères contenus dans une chaîne de caractères composant l'indice ; 5
- une étape de comparaison de mots conditionnelle consistant à comparer le mot récupéré au cours de l'étape de recherche de mots avec la chaîne de caractères constituant l'indice afin d'évaluer si, oui ou non, une condition prédéterminée est satisfaite ; et 10
- une étape d'affichage consistant à afficher le mot que l'on estime satisfaisant à la condition prédéterminée au cours de l'étape de comparaison de mots conditionnelle sur la base d'une classification en fonction de la condition prédéterminée ; 15
- dans lequel l'étape de recherche de mots consiste à effectuer une recherche, dans le moyen de stockage de mots, d'un mot ayant le nombre de caractères du mot de réponse en triant des caractères d'une chaîne de caractères, laquelle est obtenue en éliminant un symbole représentant une limite entre des mots de la chaîne de caractères composant l'indice, dans un ordre prédéterminé, et l'étape de comparaison consistant à comparer la chaîne de caractères ayant les caractères triés avec chaque mot ayant le nombre de caractères du mot de réponse se trouvant dans la liste de mots stockée dans le moyen de stockage de mots ; et 20
- dans lequel l'étape de recherche de mots consiste à trier les caractères du mot récupéré du moyen de stockage de mots (41) dans ledit ordre prédéterminé, et l'étape de comparaison consistant à comparer le mot récupéré trié avec les caractères triés de la chaîne de caractères composant l'indice. 25
- 30
- 35
5. Procédé de recherche de mots selon la revendication 4, dans lequel : 40
- ledit symbole est un espace entre des mots constituant la chaîne de caractères composant l'indice ; 45
- ledit ordre prédéterminé étant un ordre alphabétique ; et
- le mot récupéré étant stocké dans un moyen de stockage de résultat de recherche lorsqu'une correspondance est trouvée entre le mot récupéré trié et les caractères triés de la chaîne de caractères composant. 50
6. Programme de recherche de mots, comprenant une description pour faire en sorte qu'un ordinateur exécute le procédé selon la revendication 4 ou la revendication 5. 55

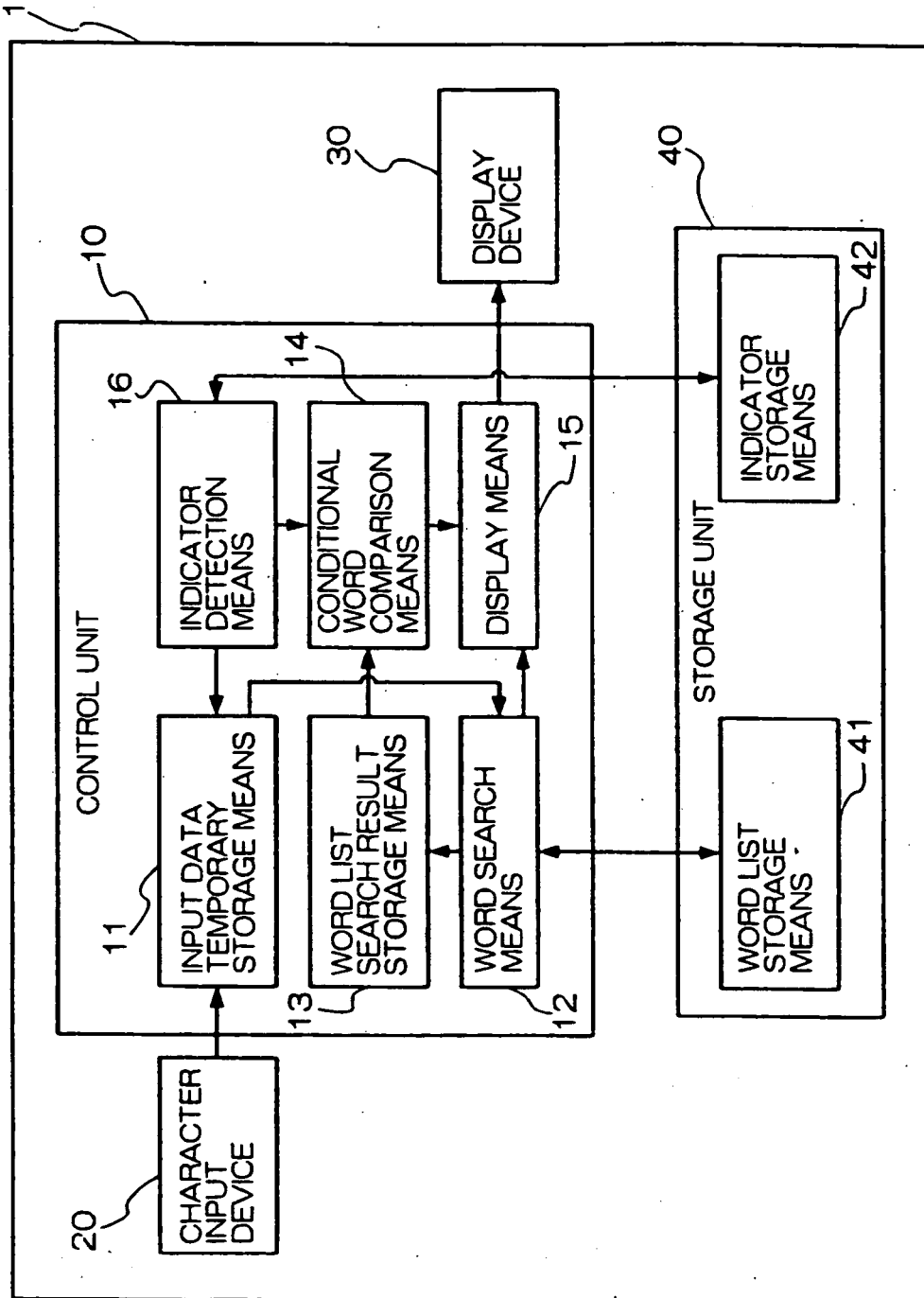


Fig.2

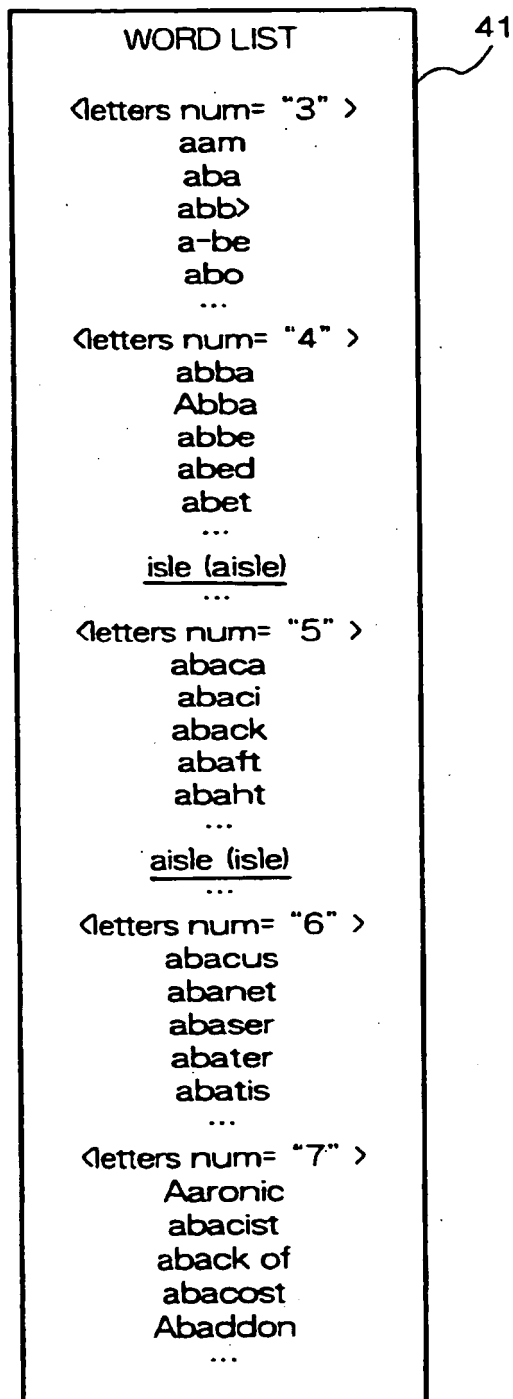


Fig.3

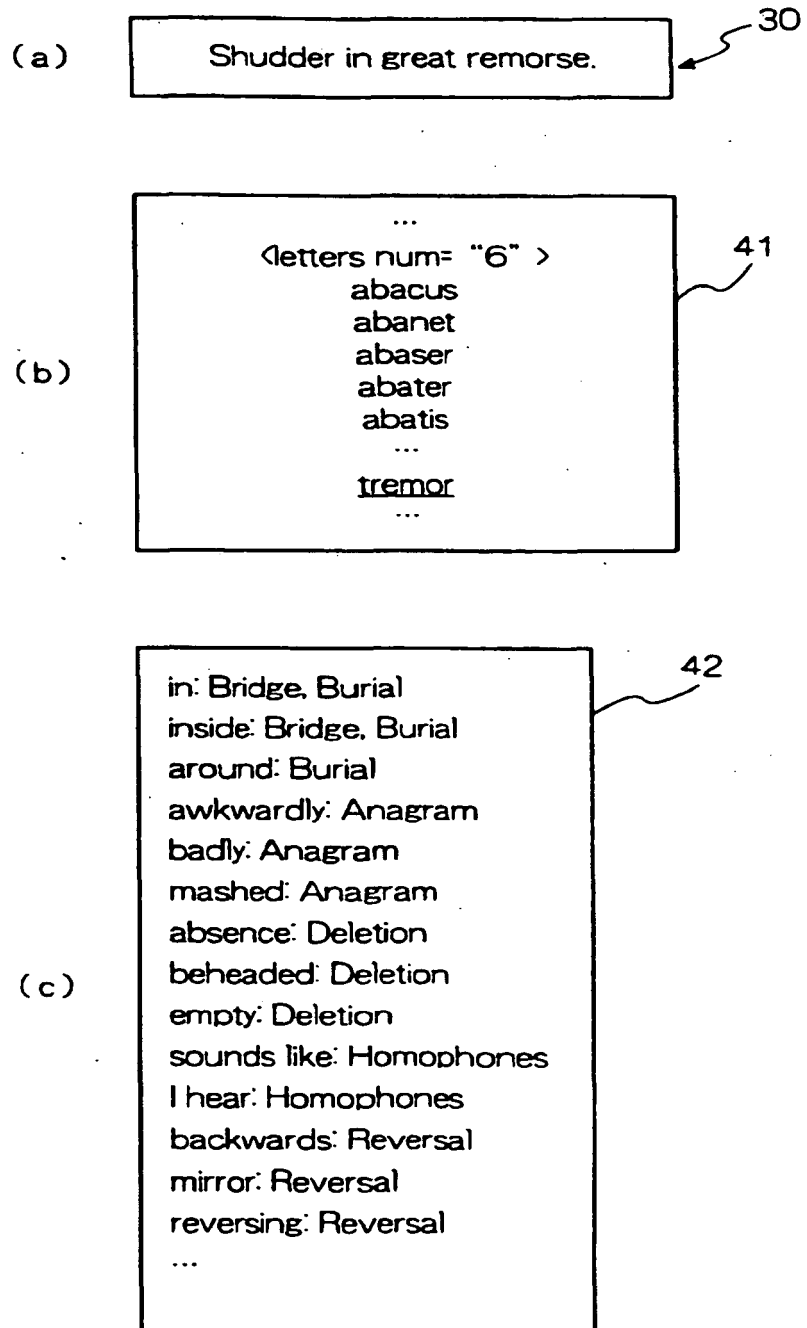


Fig.4

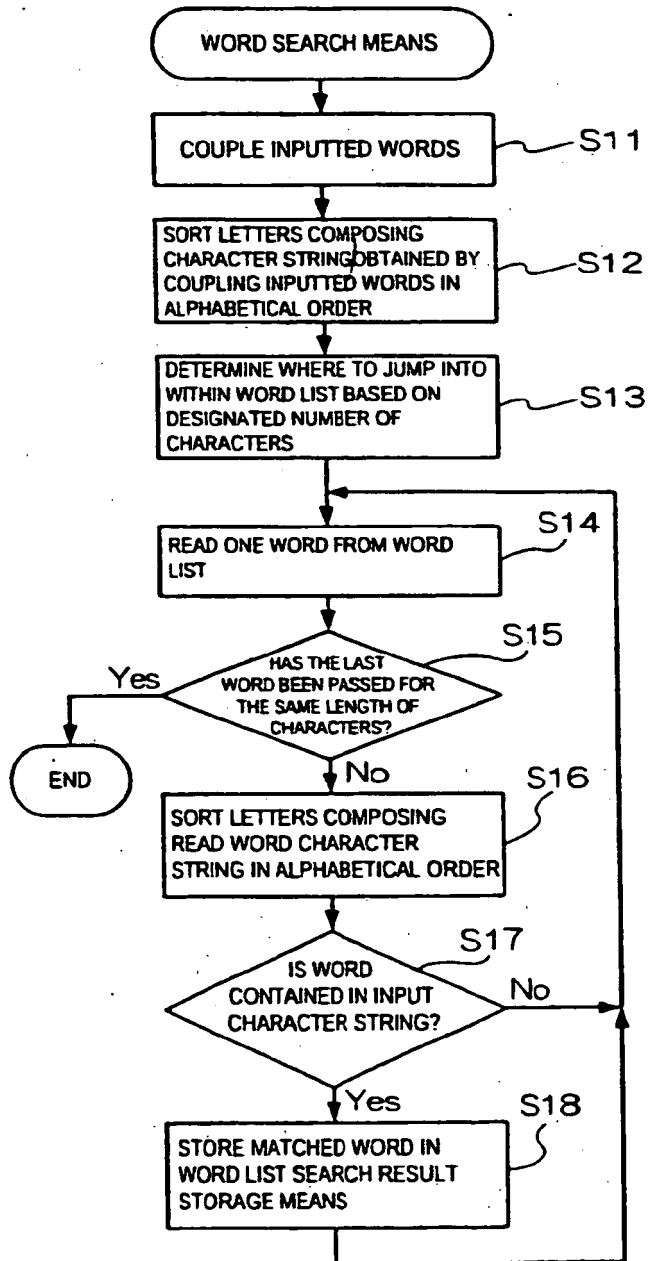


Fig.5

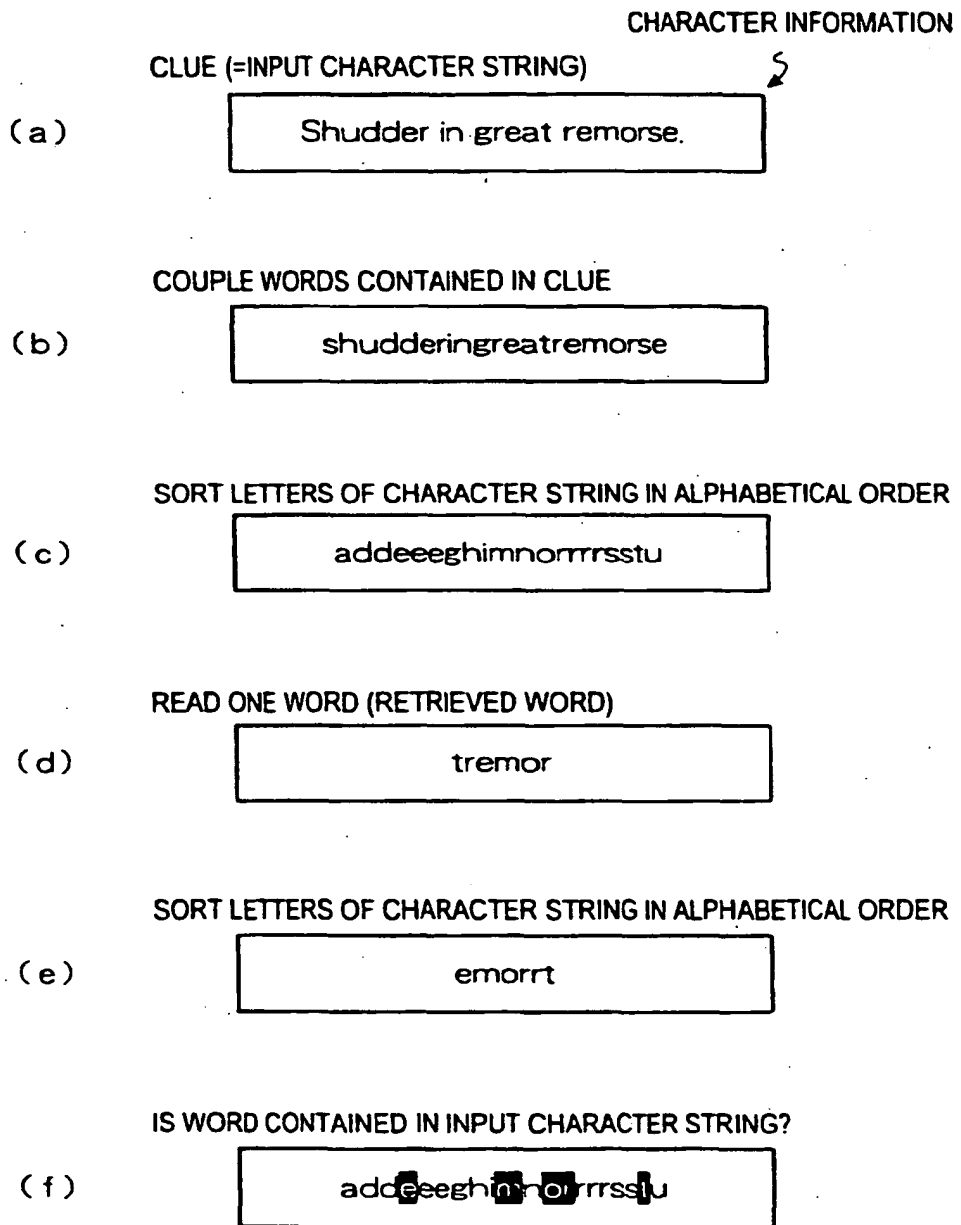


Fig.6

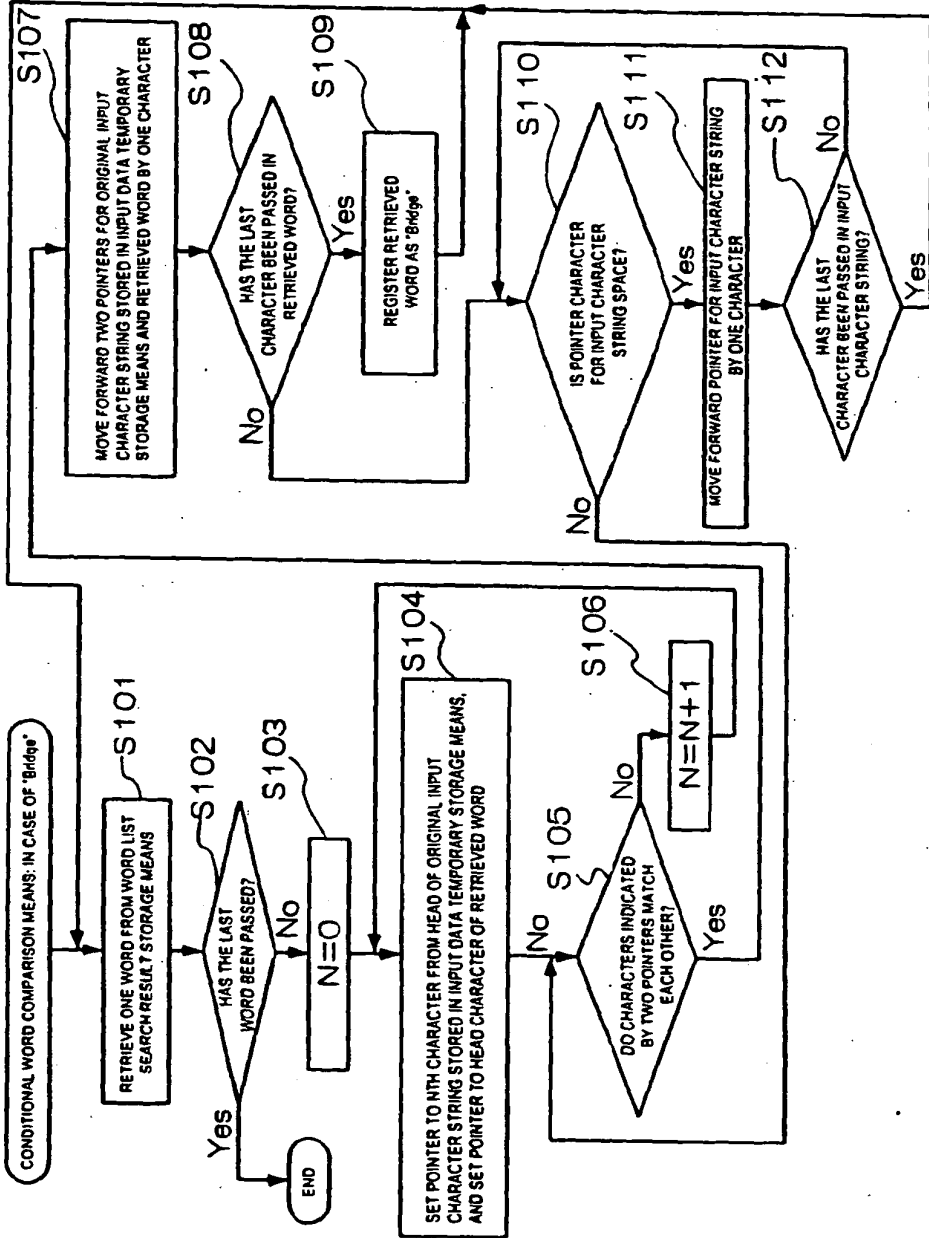


Fig.7

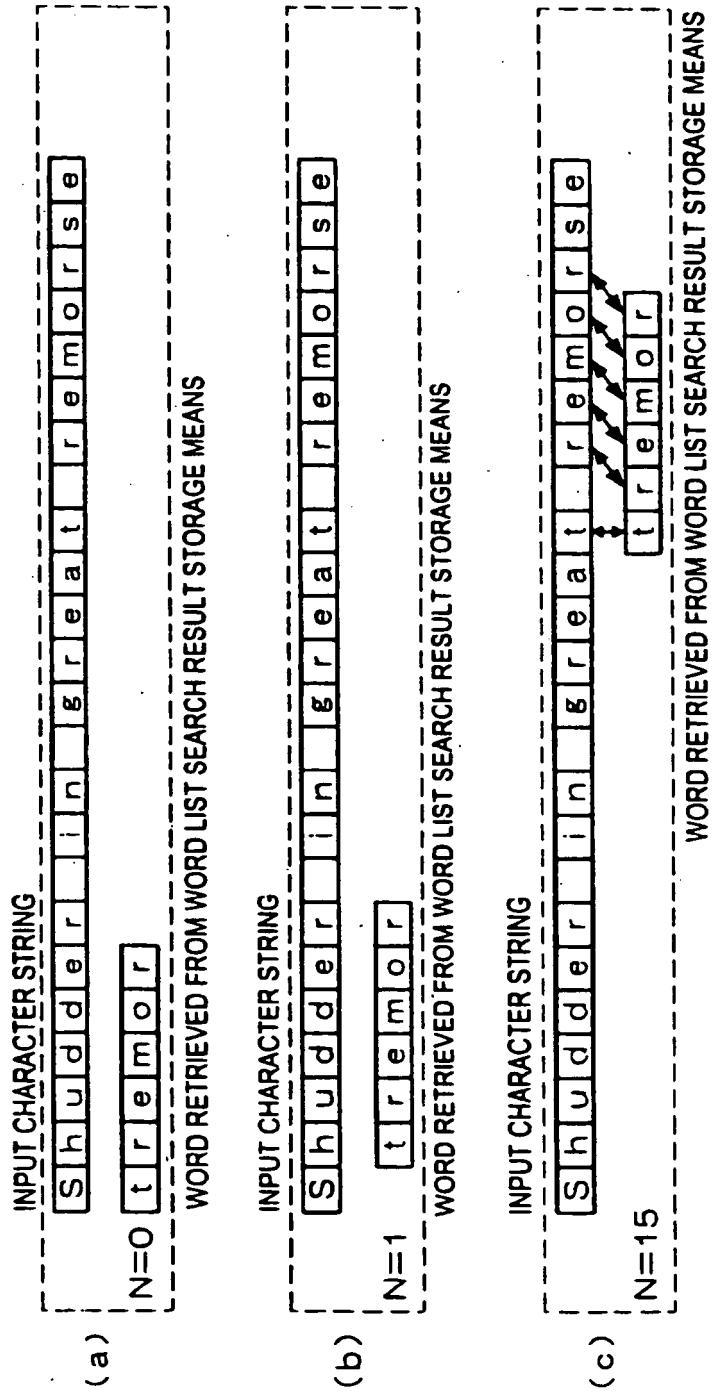


Fig.8

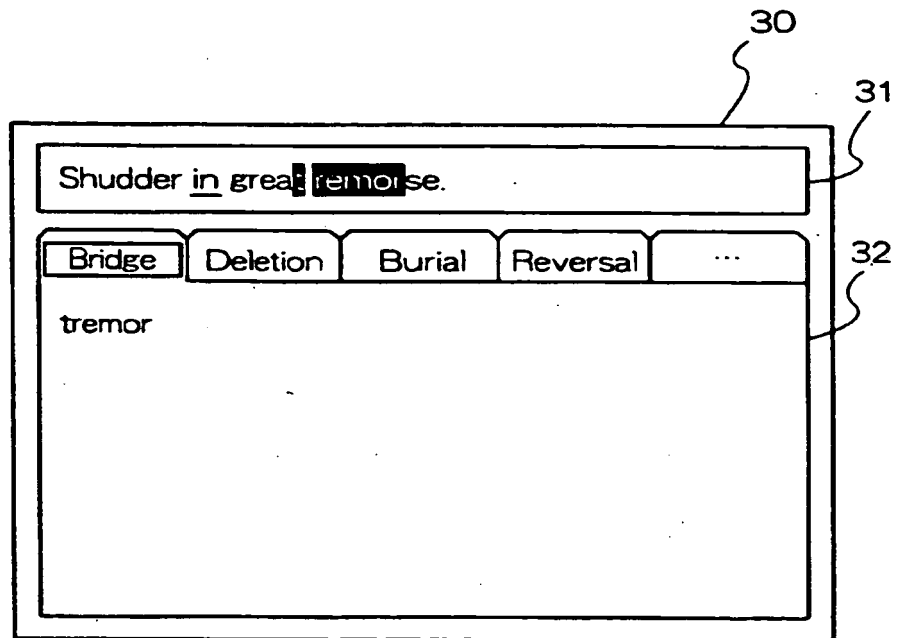


Fig.9

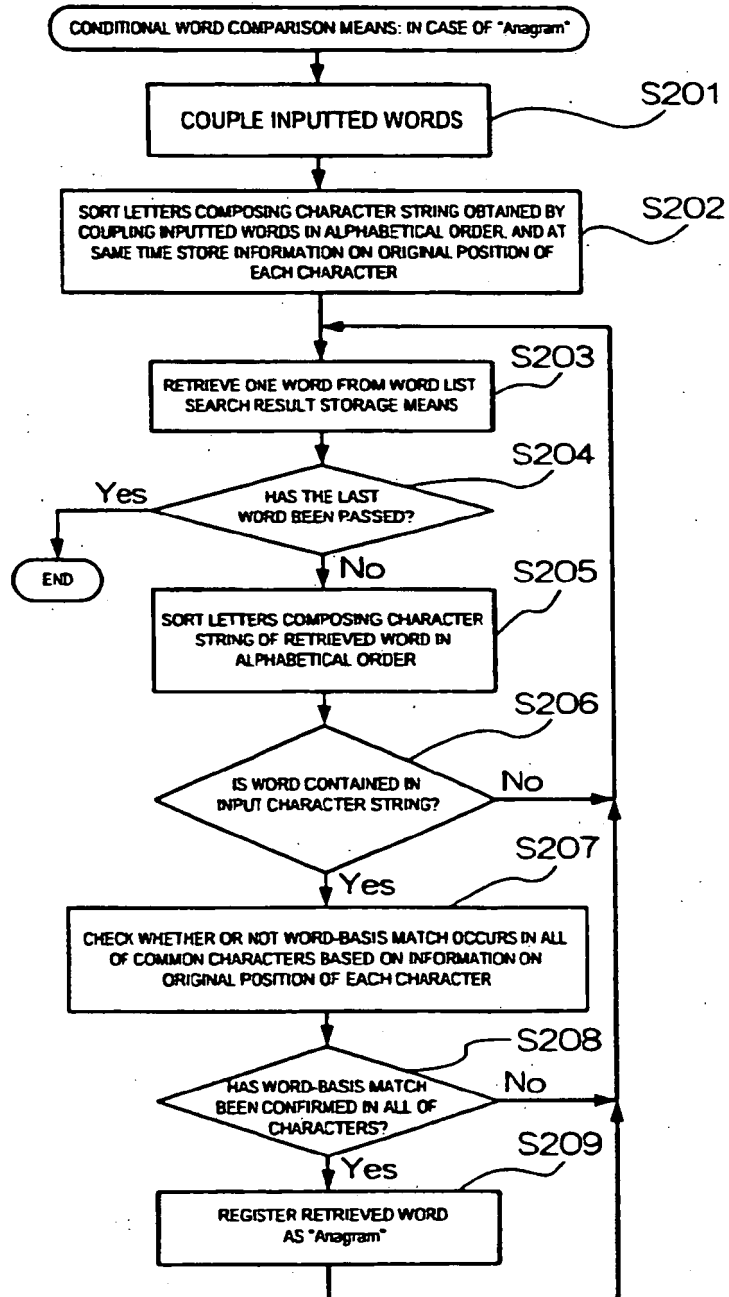


Fig.10

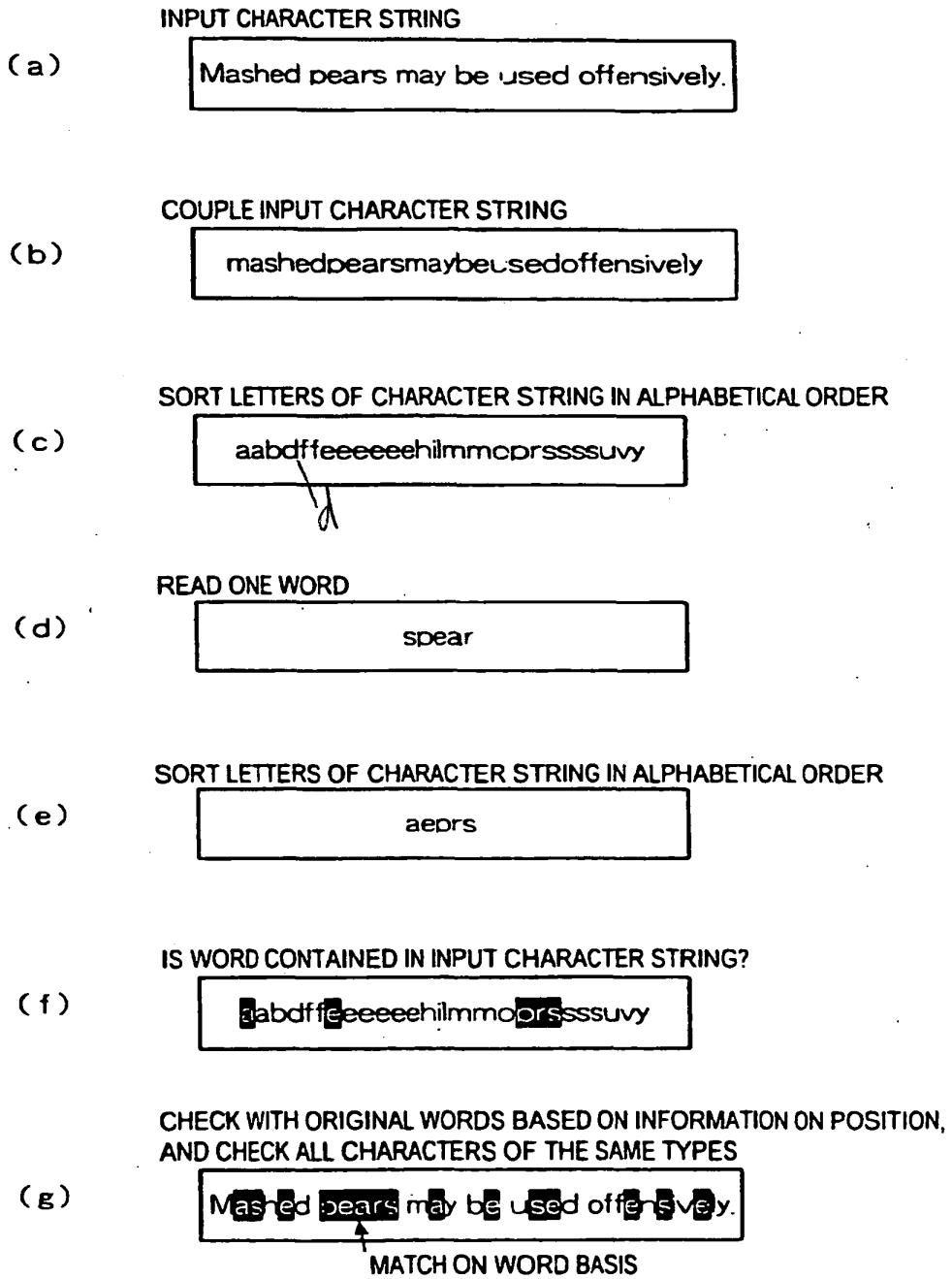
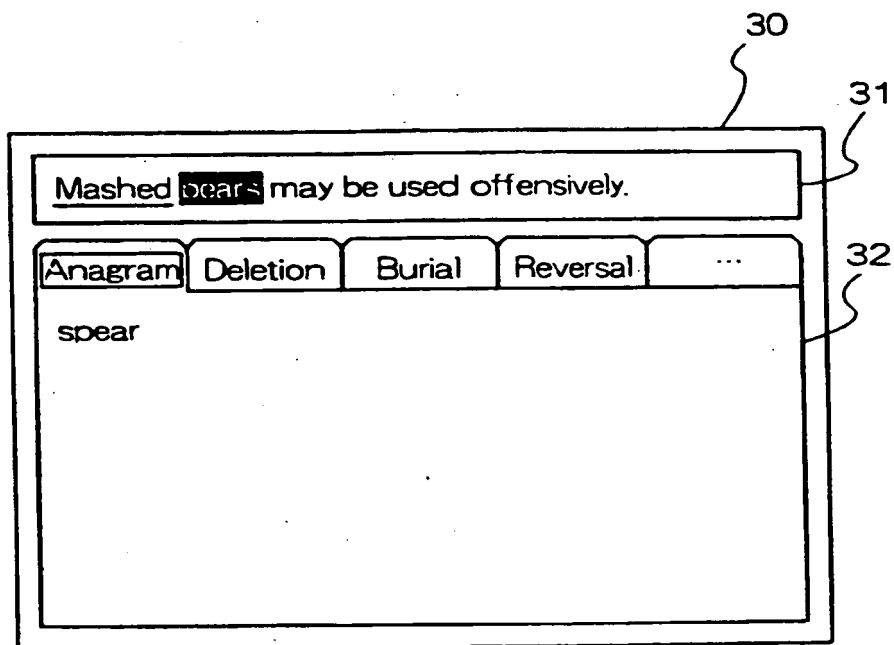


Fig. 11



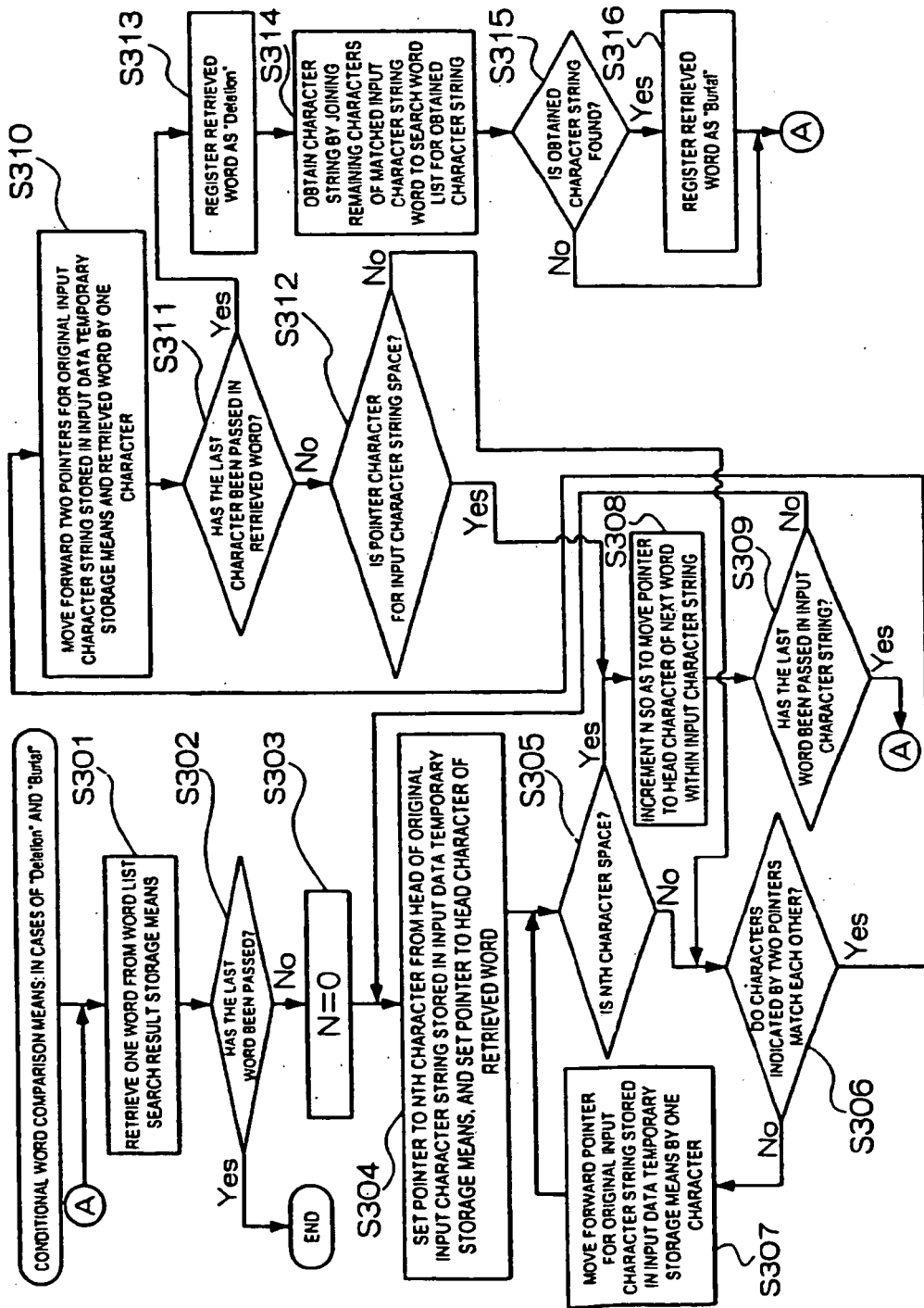


Fig.12

Fig. 13

EXAMPLE IN WHICH "Deletion" OR "Burial" IS NOT FOUND

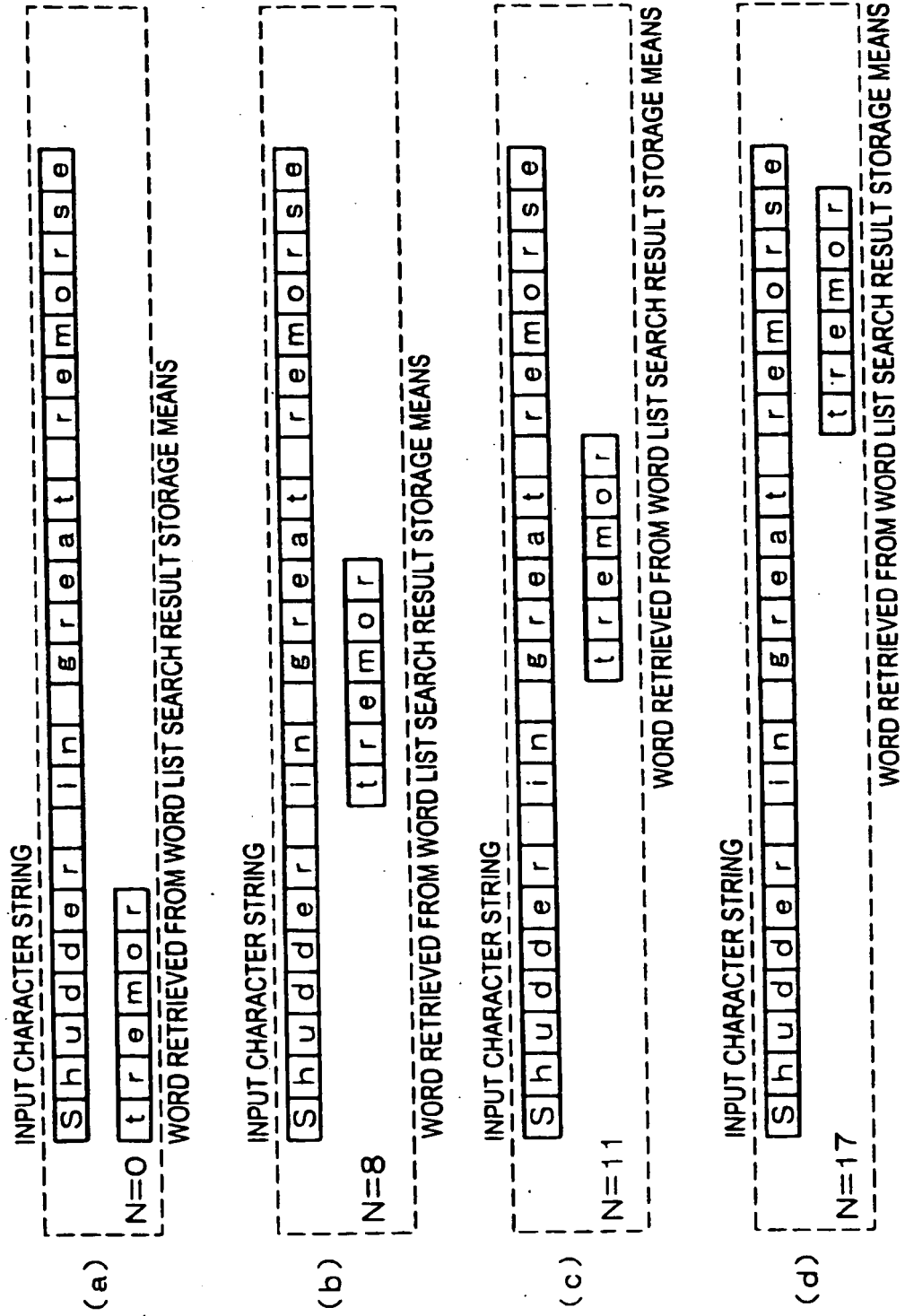
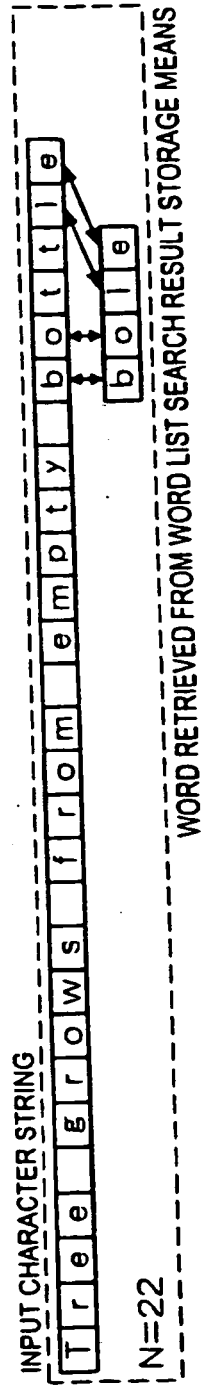


Fig. 14

(a) EXAMPLE IN WHICH "Deletion" IS FOUND



(b) EXAMPLE IN WHICH "Burial" IS FOUND

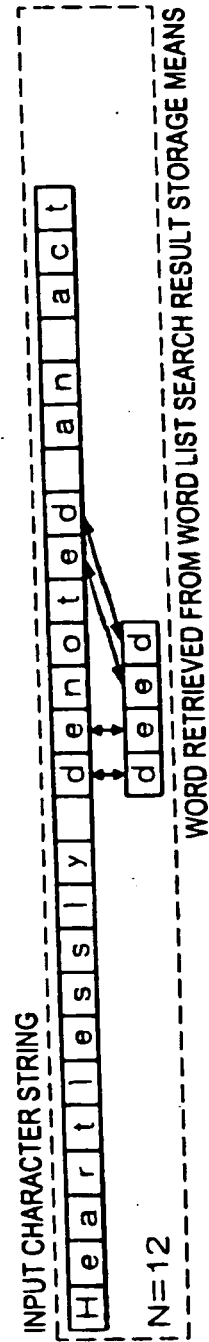


Fig.15

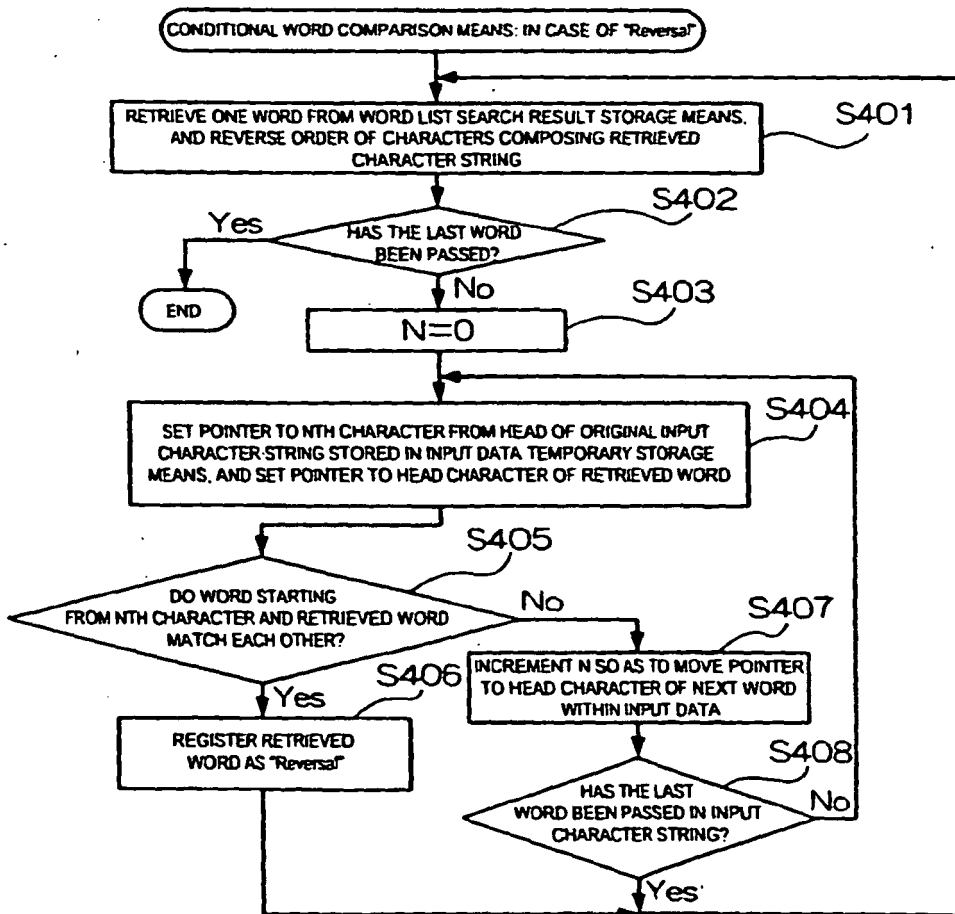


Fig. 16

EXAMPLE IN WHICH "Reversal" IS FOUND

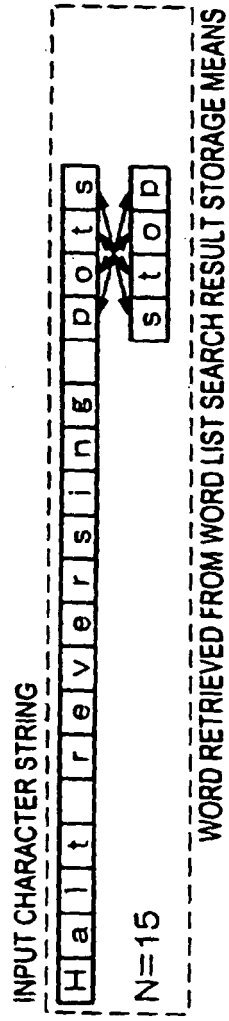


Fig.17

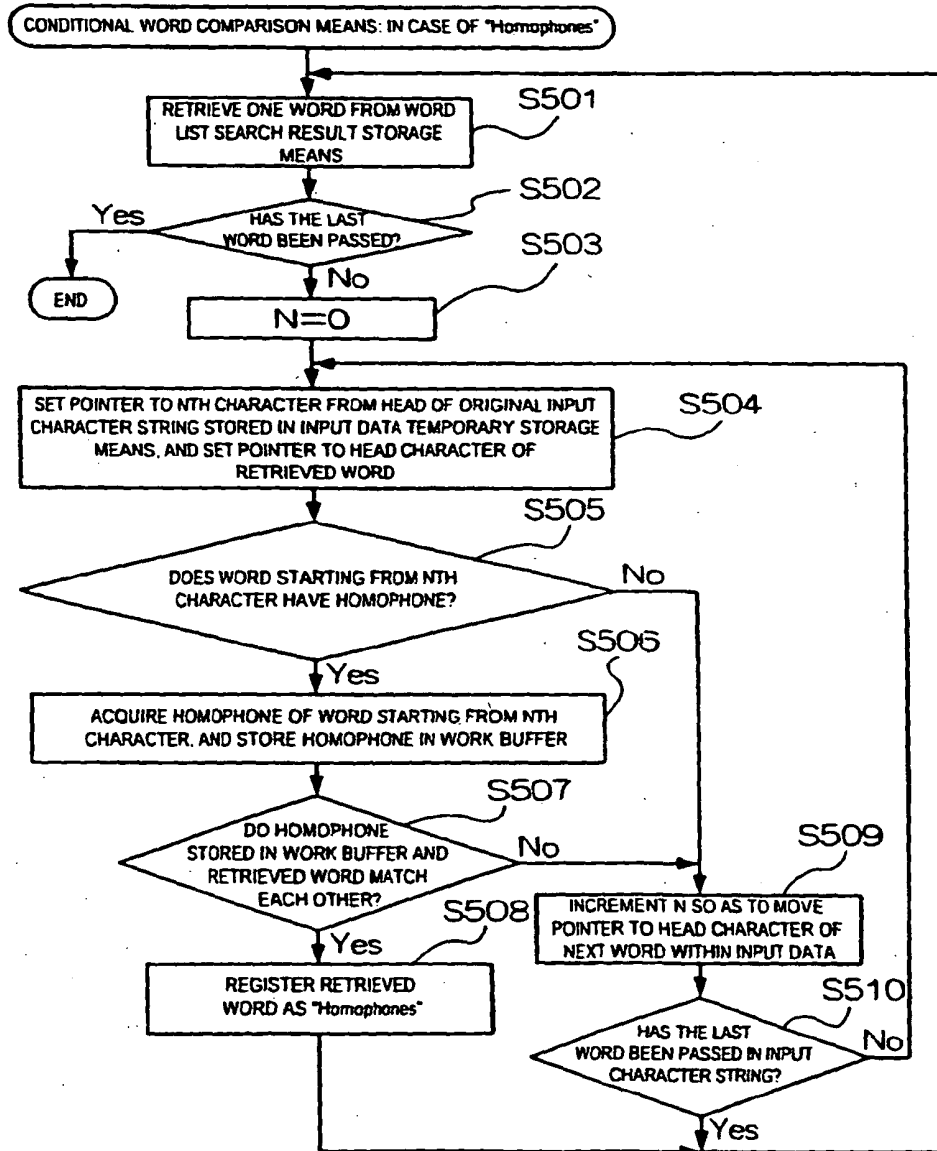
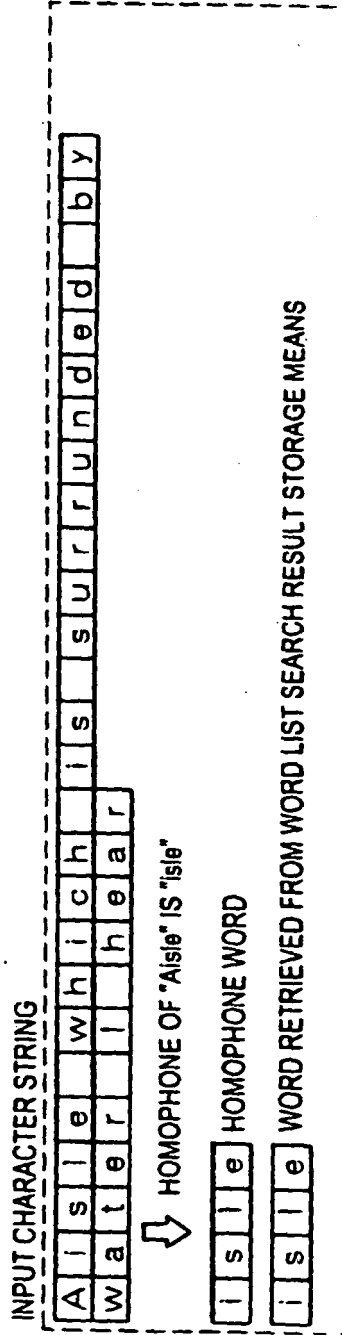


Fig.18

EXAMPLE IN WHICH "Homophones" IS FOUND



**REFERENCES CITED IN THE DESCRIPTION**

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