United States Patent

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[54] **DATA PROCESSING EQUIPMENT INCLUDING IMPROVED KEYBOARD**

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[51] **Int. Cl.**.....**G11b 5/02**

[58] **Field of Search**...346/74 MP, 8 M; 340/174.1 G, 340/172.5; 178/17.5, 17 A, 17 C

[56] **References Cited**

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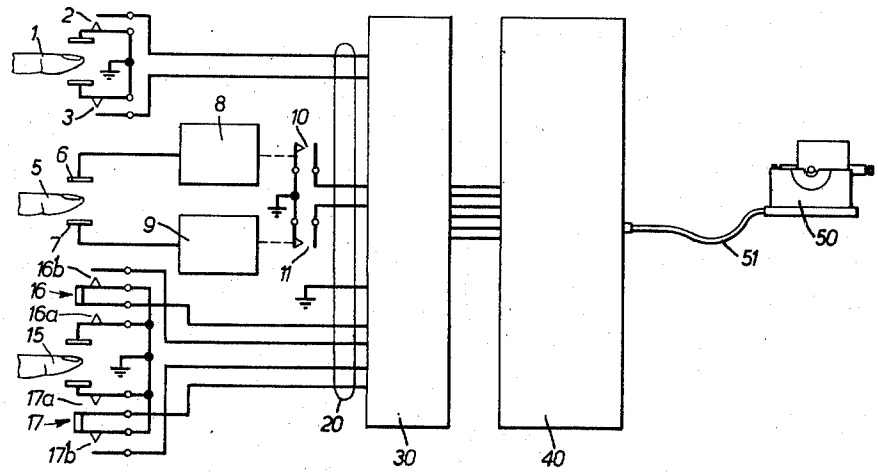
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[57] **ABSTRACT**

A typewriter is operated rapidly by providing a keyboard which is operated by finger or thumb movement only, storing coded signals from the keyboard and de-coding the signals to operate the typewriter, the signals being supplied to the typewriter at the optimum speed for operation of the typewriter.

9 Claims, 2 Drawing Figures



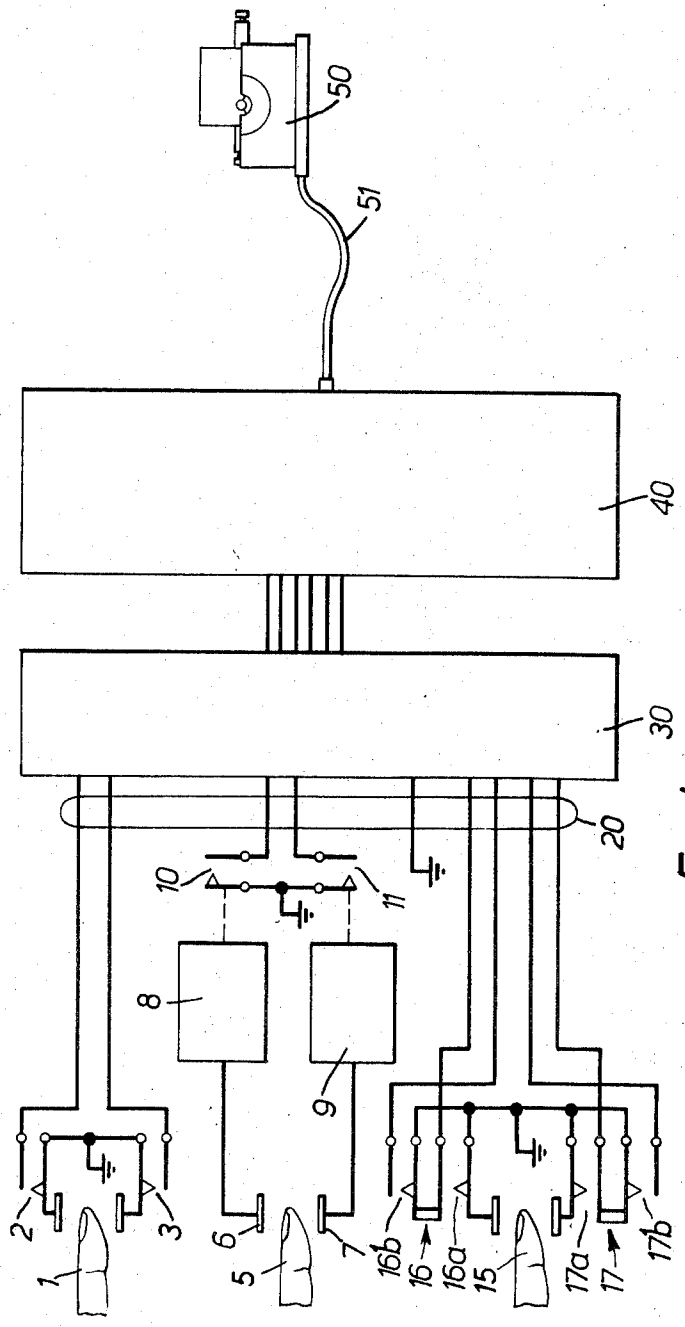


FIG. 1.

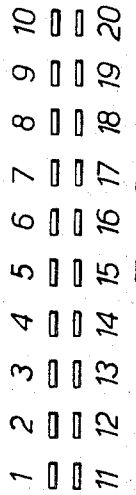


FIG. 2.

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DATA PROCESSING EQUIPMENT INCLUDING IMPROVED KEYBOARD

This invention relates to an improved system for providing a verbal input to data-processing equipment. Although the invention will be specifically described in relation to the control of an electric typewriter, it may be applied to other systems requiring an input in the form of word-representative series of characters.

The expression "verbal data" is used herein in a broad sense to include any data which is generally verbal in character including for example computer programs as well as conventional words.

The invention provides apparatus adapted for use in processing verbal data comprising (a) a keyboard adapted to generate coded signals corresponding to verbal data, the keyboard lying generally within the span of the operator's hands and being adapted to fit the hands so that only movement of the fingers or thumbs is required to operate the keyboard, and (b) means for storing the coded signals for subsequent processing.

The invention also provides a method of processing verbal data comprising the steps of generating coded signals corresponding to the verbal data by operating a keyboard which lies generally within the span of the operator's hands and is adapted to fit the hands so that only movement of the fingers or thumbs is required to operate the keyboard, and storing the coded signals for subsequent processing.

As applied for example to the control of a typewriter, a system embodying the invention by way of example comprises the following main subsystems:

1. Keyboard
2. Buffer store
3. Main store
4. Electric typewriter

The keyboard is characterized by:

a. Being so shaped to fit the hands that only movement of the fingers and thumbs is required to close the key contacts, and no movement of the hands or arms is required.

b. By keys being provided both above and below the rest positions of the digits so as to increase the total number of keys which may be actuated.

c. By closure of the key contacts being effected either in one embodiment by mechanical movement produced by pressure from the appropriate digit or, in another embodiment, by means responsive to the proximity of the appropriate digit.

d. By comprising one or more keys each capable of producing different contact actions in response to greater or less applied pressure of a single digit, thus again increasing the total number of switch actions which may be provided.

e. By being so shaped as to be comfortably supported upon the knees of an operator yet also to be capable of being supported stably upon a flat surface.

The buffer store which is directly controlled by the actuation of the keyboard contacts serves the purpose of storing the combinations of contact operations of the keyboard and of passing these combinations on to the main store at an appropriate rate, thus allowing continuous use of the keyboard despite the necessarily discontinuous action of the typewriter.

The function of the main store is:

a. To store codes representing all the combinations of key actuation from the keyboard and to convert these codes into signals suitable for driving the typewriter.

b. To respond to particular codes or code combinations by developing series of signals which when applied to the typewriter result in the recording of predetermined words or phrases.

c. To provide to the typewriter actuating signals which are so timed as to take into account the limitations resulting from the construction of the typewriter: thus closely-spaced typebars cannot be operated in as rapid succession as more widely spaced typebars, in order to avoid interference between the typebars, to ensure adequate time for carriage return, and so on. It should be possible to vary the speed factors here adopted, in order to adapt the store for use with differently responding typewriters.

d. The store is so programmed as to minimize the amount of coded information required to represent the most commonly used characters and functions.

e. The store should be so constructed that information contained in the store can only be erased as a result of a deliberate operation requiring actions which do not form any part of the normal operating programme of the system.

The typewriter used in the system must be capable of, and preferably designed for, conversion to accept print-out signals from the main store. It will be advantageous if the "printing gate" is modified to give the type bars a one-way locus and hence minimize interference between the type-bars during high speed operation.

In the accompanying drawings:

FIG. 1 illustrates schematically an embodiment of the invention; and

FIG. 2 is a diagrammatic representation of a keyboard comprising two sets of ten keys.

At the left-hand side of the FIG. 1 are illustrated three alternative arrangements for digital key-contact operation. A digit 1 is positioned between two pressure-actuated contact sets 2 and 3, pressure upwards thus closes contact set 2, while downward pressure closes contact set 3. Either contact set may be omitted should a particular operator not have the capability of effectively operating it.

A digit 5 is disposed between proximity-sensitive plates 6, 7 each of which is electrically connected to a respective sensitive circuit 8, 9 which is adjusted to respond to close association of a digit with the respective plate. Each of circuits 8, 9 – which in practice may comprise an oscillator which commences or ceases to oscillate in response to increased capacitance to earth associated with the respective plate, a rectifier converting the oscillator output into a change of direct current and a relay responsive to the change in current to alter the setting of a contact set – is arranged to close the respective one of contact sets 10, 11 in response to close proximity of the digit with the respective sensing plate.

A digit 15 is shown associated with two dual-pressure contact sets 16 and 17. Each of these contact sets includes a first pair of contacts 16*a*, 17*a* which is closed by a first pressure in the appropriate direction and a second pair of contacts 16*b*, 17*b*, which is closed by a

second and increased pressure in the same direction. It will be seen that four different contact conditions may thus be obtained in response to movement of a single digit.

The code conditions set up by digital actuation of the contact sets **2, 3, 10, 11, 16** and **17** are fed by way of a cable **20** into a buffer store **30**. In buffer store **30** the code combinations established by the actuation of the key contacts, of which there may obviously be more sets than are shown in the drawing, are stored temporarily and fed out to a main store **40** as called up. As set out previously, main store **40** is arranged to accept both code combinations representing the **44** characters and five functions of the standard typewriter and also other code combinations chosen to represent words and/or phrases commonly used in the work for which the system is employed. In response to a word or phrase combination the main store yields to the typewriter **50**, over a cable **51**, signals causing the required word or phrase to be typed at the maximum speed of which the machine is capable. During such times as the main store is causing the typewriter to type a word or phrase the code combinations established by the keyboard contacts are stored in the buffer store until called up by the main store when the word or phrase has been completed.

Assuming that all ten digits are employed to control two key contacts each a total of **20** contact operations can be produced. By taking all code permutations formed by a unique pair of key contact actuations a total of some 400 codes is possible. Thus allowing for direct operation of the typewriter there remain some 350 code permutations which may be used to initiate the typing of selected words or phrases. Alternatively combinations may be used rather than permutations but this reduces the number of available codes.

The distribution of word usage is such that normal communication follows zipf's law, that is, the frequency of occurrence of a word is inversely proportional to its rank order. This means that although two key choices are required for each character, word or phrase, the resultant number of characters selected per key actuation is greater than unity and varies upwards depending upon the subject matter of the communication and the choice of words and phrases in the store.

As a result the system may permit for example an increase in the average typing speed to approximately double that for the same rate of key selection in a normal typewriter. As the physical movement required for key selection is very slight the rate of key selection may be considerably increased over that possible with a standard typewriter, with the result that typing speeds become possible which are similar to normal shorthand or stenotype speeds. The learning of shorthand may therefore by replaced by the learning of the vocabulary available in the typing system.

Since only light currents are controlled by the keyboard, this may be connected to the remainder of the system by a flexible cable, so that direct dictation to the keyboard operator is possible without disturbing noise. The typewriter itself may be positioned under a sound-proof cover in the same room, or possibly without such a cover in an adjoining or remote room.

It is an advantage of a communication system of the kind described above that owing to the fact that minimal digital movement is required to operate the key contacts it may be used by almost wholly paralyzed operators but its usefulness is by no means restricted to such applications. When an operator has one or more digits immobilized or absent the key combinations to which the main store responds may be changed so that all typewriter functions may be produced by the available code combinations. Also with disabled operators the span of the keyboard may be reduced to lie within the span of what the operator has available, e.g., only one hand may be available. If necessary combinations of three key actuations may be employed to supplement the available two-key combinations. This latter expedient may be employed to enlarge the vocabulary of a system for use by the fully able.

The typewriter is operated at the maximum speed which is obtainable without clashing of the typebars. The typewriter comprises for example a plurality of small solenoids (not shown) one below each key and arranged to operate its key in response to a signal from the main store.

FIG. **2** illustrates a keyboard comprising two sets of ten keys each pair of upper and lower keys, e.g., keys I and II being operated by upward or downward movement of the same finger. It will be realized that this keyboard permits 400 different permutations of codes each code comprising two digits e.g., (1,2), (1,11), (11,1) provided that the equipment is arranged to distinguish between different permutations as opposed to merely distinguishing between different combinations, e.g., to distinguish (1,2) from (2,1); (1,2) is obtained by operating first key 1 followed by key 2 whereas (2,1) is obtained by operating first key 2 followed by key 1. If "three" codes are employed, e.g., (1,2,3), (13,11,14), it will be realized that even more permutations are possible; even "four" codes may be employed in appropriate cases.

In a test it was found that a 50 per cent increase in typing output could be obtained by having codes corresponding to the 400 most common words found in 100,000 different words which appeared in **5** million words of running text, these codes being in addition to those corresponding to the 49 normal typewriter functions.

In a modification of the apparatus the output from the main store is recorded on magnetic tape for subsequent reproduction. It will be realized that the tape or the direct output from the main store may be used to control equipment other than a typewriter, e.g., a duplicating machine, an automatic type-setting machine, or a computer (in which case the programme is generated at the keyboard).

It is believed that the invention is useful for any verbal data having a vocabulary of for example 40 words or more.

In another modification a data display unit is coupled to the main store and displays the data in de-coded form before it is supplied to the typewriter or the like; this can be used to facilitate making corrections prior to supply of the output to the typewriter, by providing at the keyboard codes for restraining the output from the main store and releasing the output when required and for providing cancellation and correction facilities.

In modifications of the keyboard the operation is by sideways finger movement rather than up and down

movement. Also sideways movement may be combined with up and down movement to actuate several keys. Also use may be made of various flexing movements of the fingers.

The input from one keyboard may be used to supply output to more than one typewriter or the like, or for example the output could be used to operate simultaneously by a type-setting machine and a display unit at an editor's desk.

What I claim is:

1. Typewriting apparatus comprising (a) a keyboard adapted to generate signals corresponding to coded verbal data represented by combinations of key actuations with certain single codes each corresponding to a predetermined complete wording, the keyboard being arranged so that it may be operated by finger or thumb movement only with substantially no bodily movement of the hand or arm and comprising an upper series of keys and a lower series of keys, a space being defined between said upper series and said lower series for the reception of the operator's fingers, (b) typewriting mechanism adapted to reproduce the verbal data in decoded form, and (c) means for receiving the signal-output from the keyboard and for operating the typewriter mechanism in response to said output, said means being programmed to develop said predetermined complete wordings at the typewriter mechanism in response to output signals from the keyboard corresponding to said single codes.

2. In verbal data handling apparatus, the combination of (a) a keyboard adapted to generate signals corresponding to coded verbal data represented by combinations of key actuations, the keyboard being arranged so that it may be operated by finger or thumb movement only with substantially no bodily movement of the hand or arm and comprising an upper series of keys and a lower series of keys, a space being defined between said upper series and said lower series for the reception of the operator's fingers and (b) buffer means for storing signals from the keyboard and simultaneously delivering a signal-output, said buffer means having a storage capacity sufficient to store signals from the keyboard substantially independently of the rate of simultaneous signal output from the buffer means.

3. The combination of claim 2, further comprising means for receiving the output from the buffer means and for recording data corresponding to said output on magnetic tape.

4. The combination of claim 2, wherein the verbal data is computer programming data and further comprising means for receiving the output from the buffer means and for programming a computer with data generated at the keyboard.

5. In typewriting apparatus the combination of (a) a keyboard adapted to generate signals corresponding to coded verbal data represented by combinations of key actuations with certain single codes each corresponding to a predetermined complete wording, the keyboard being arranged so that it may be operated by finger or thumb movement only with substantially no bodily movement of the hand or arm and comprising an upper series of keys and a lower series of keys, a space being provided between said upper series and said lower series for the reception of the operator's fingers, and (b) means for receiving the signal-output from the keyboard and for operating a typewriter mechanism in response to said output, said means being programmed to develop said predetermined complete wordings at the typewriter mechanism in response to output signals from the keyboard corresponding to said single codes.

6. Data handling apparatus comprising:

a. means including a digitally actuated keyboard adapted by combinations of key actuations to generate input electrical signals corresponding to coded verbal data and comprising an upper series of keys and a lower series of keys, a space being defined between said upper series and said lower series for the reception of the operator's fingers,

b. transfer means,

c. buffer means directly electrically connected between said signal generating means and said transfer means adapted to receive and store said input signals in coded combinations,

d. said transfer means being adapted for receiving coded combination signals from said buffer means at a controlled rate and for producing output signals, said buffer means having a storage capacity sufficient to store input signals independently or the rate the buffer means simultaneously supplies coded combination signals to said transfer means, and

e. reproducing means directly electrically connected to the output of said transfer means for receiving the output signals from said transfer means and reproducing data corresponding to the signals generated at said keyboard.

7. In the data handling apparatus defined in claim 6, said reproducing means comprising typewriting mechanism adapted to reproduce the verbal data in decoded form.

8. Apparatus according to claim 7 wherein certain single codes generated at said keyboard each correspond to a predetermined complete wording and said transfer means is programmed to develop said predetermined complete wordings at the typewriter mechanism in response to output from the buffer means corresponding to said single codes.

9. Data handling apparatus comprising:

a. means including a digitally actuated keyboard adapted by combinations of key actuations to generate input electrical signals corresponding to coded verbal data, at least one key being dually actuable, one actuation being produced by a lesser digital pressure and the other by a greater digital pressure,

b. transfer means,

c. buffer means directly electrically connected between said signal generating means and said transfer means adapted to receive and store said input signals in coded combinations,

d. said transfer means being adapted for receiving coded combination signals from said buffer means at a controlled rate and for producing output signals, said buffer means having a storage capacity sufficient to store input signals independently of the rate the buffer means simultaneously supplies coded combination signals to said transfer means, and

e. reproducing means directly electrically connected to the output of said transfer means for receiving the output signals from said transfer means and reproducing data corresponding to the signals generated at said keyboard.

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