Dec. 28, 1965 W. A. AYRES 3,225,883

WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS

Filed Nov. 13, 1962 9 Sheets-Sheet 1

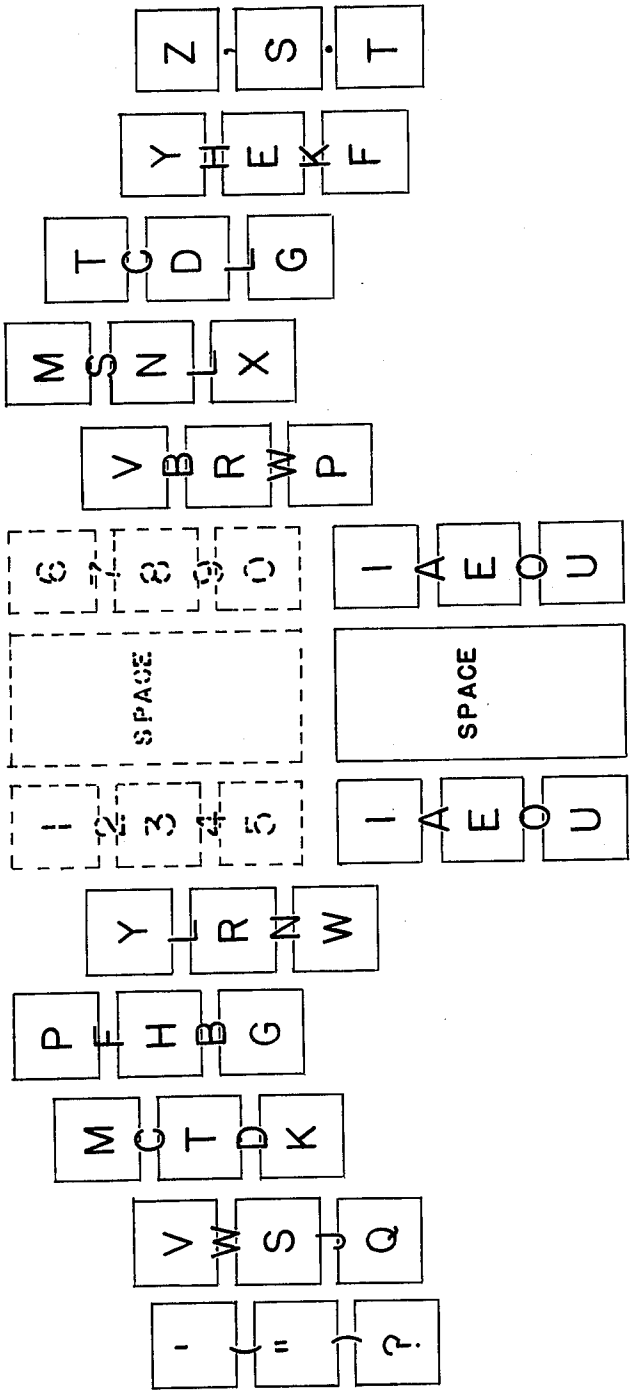

FIG. 1.

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Dec. 28, 1965 W. A. AYRES 3,225,883
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Filed Nov. 13, 1962 9 Sheets-Sheet 2

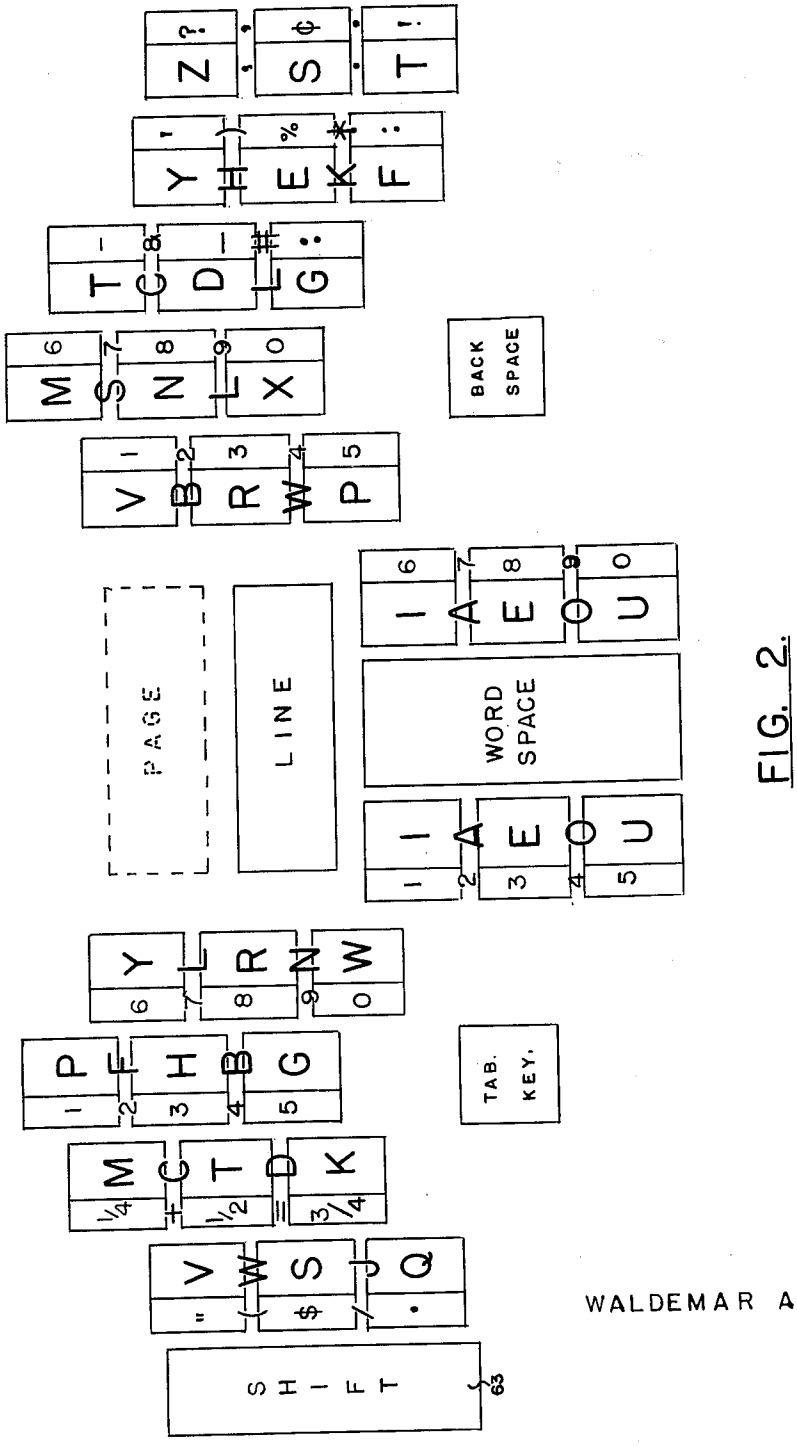

FIG. 2.

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Filed Nov. 13, 1962 9 Sheets-Sheet 3

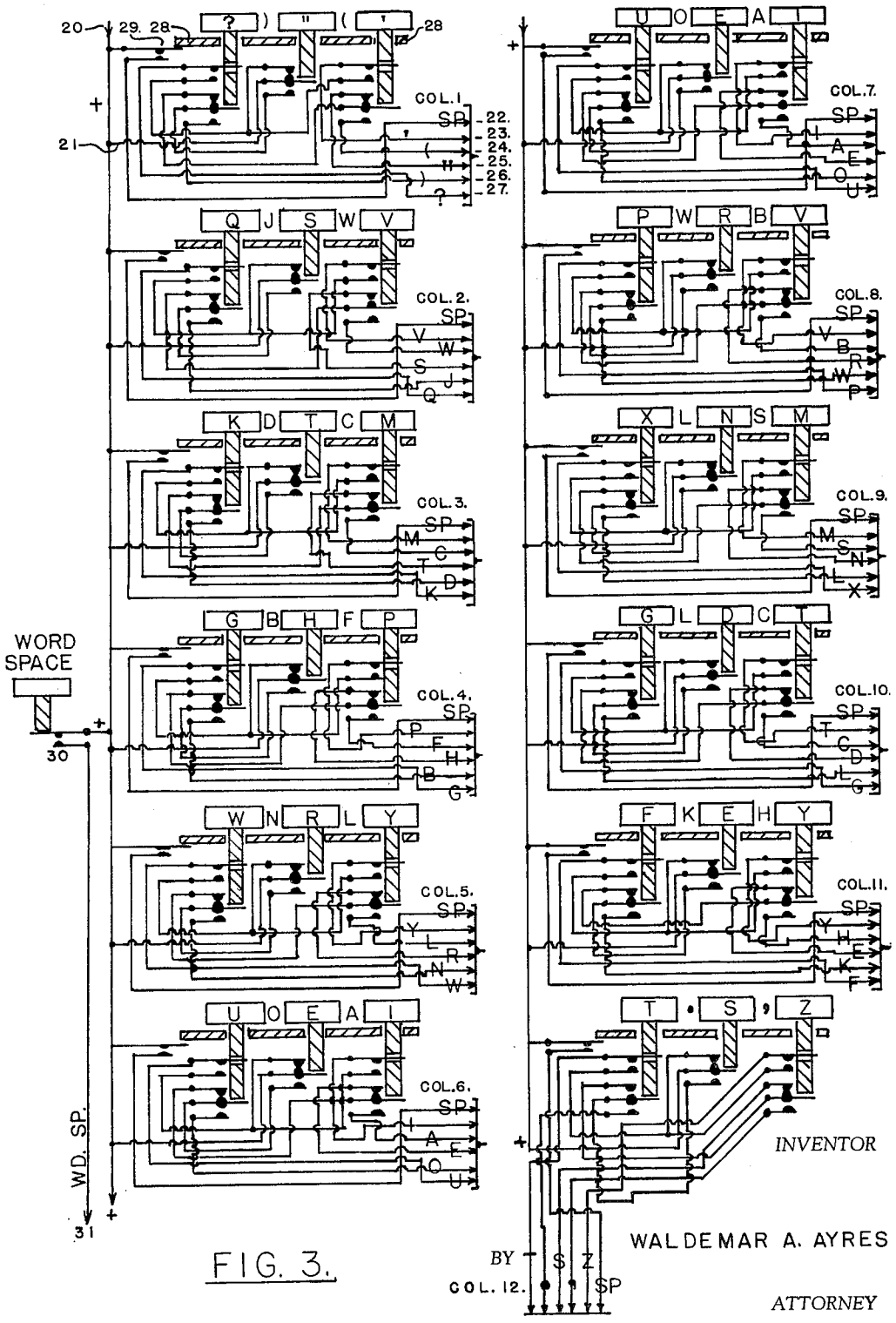

FIG. 3.

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WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS

Filed Nov. 13, 1962 9 Sheets-Sheet 4

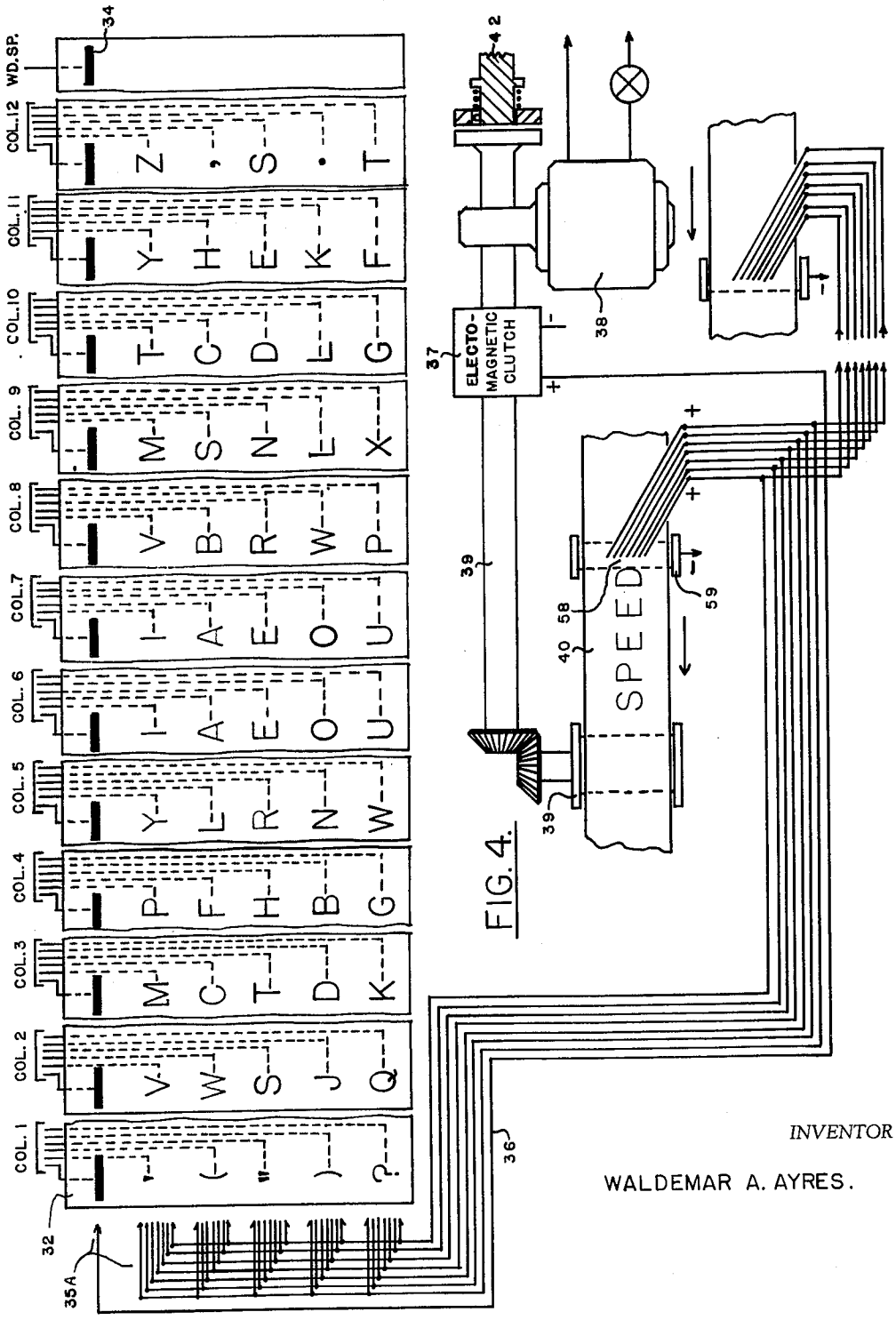

FIG. 4.

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WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS
Filed Nov. 13, 1962 9 Sheets-Sheet 5

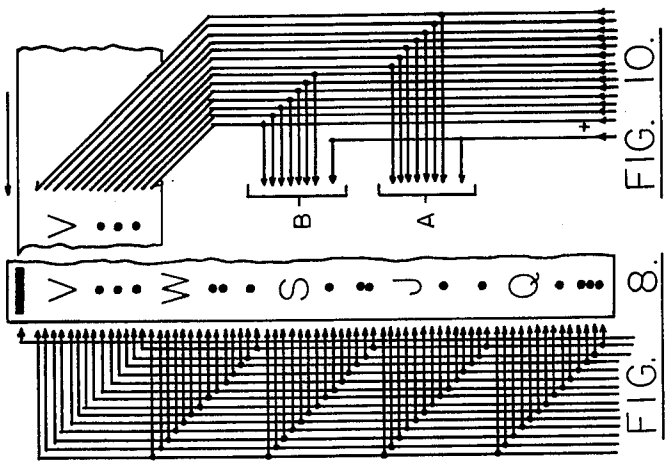

FIG. 10.

FIG. 8.

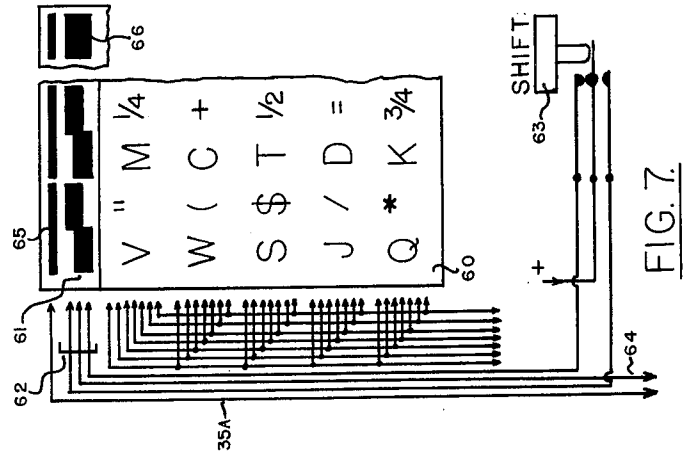

FIG. 7.

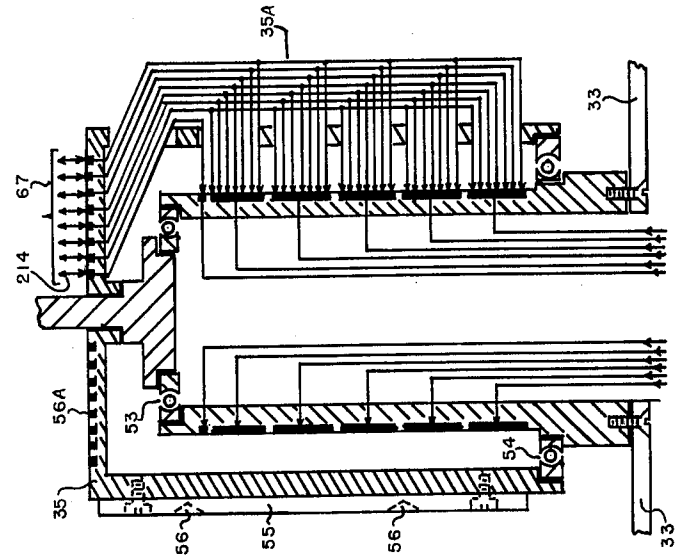

FIG. 5.

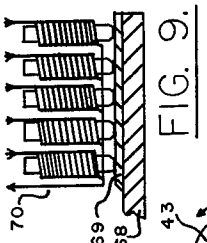

FIG. 9.

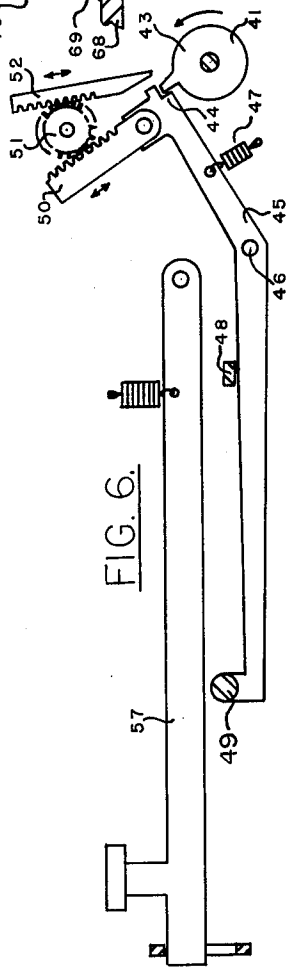

FIG. 6.

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WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS

Filed Nov. 13, 1962 9 Sheets-Sheet 6

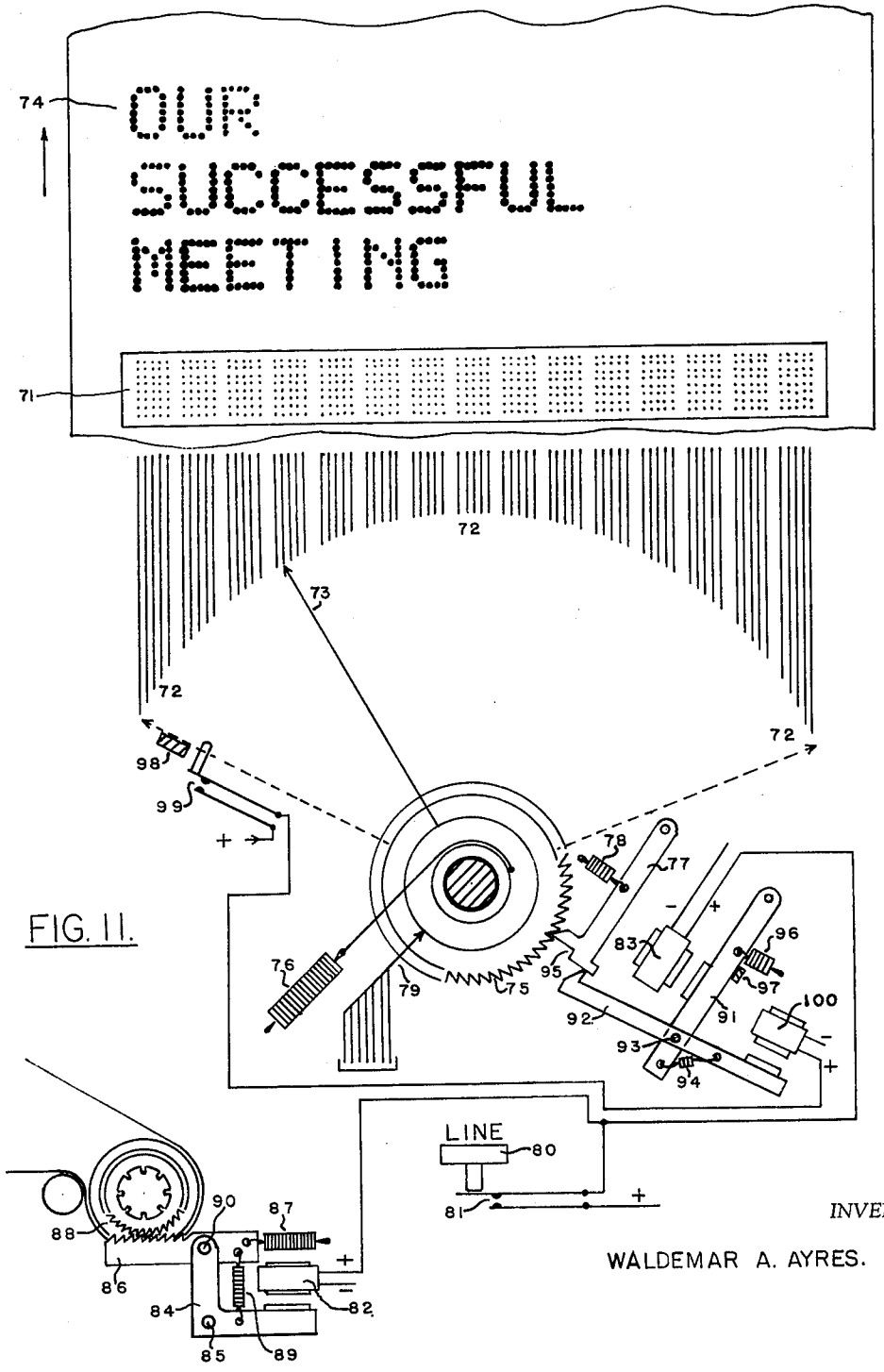

FIG. 11.

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WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS

Filed Nov. 13, 1962 9 Sheets-Sheet 7

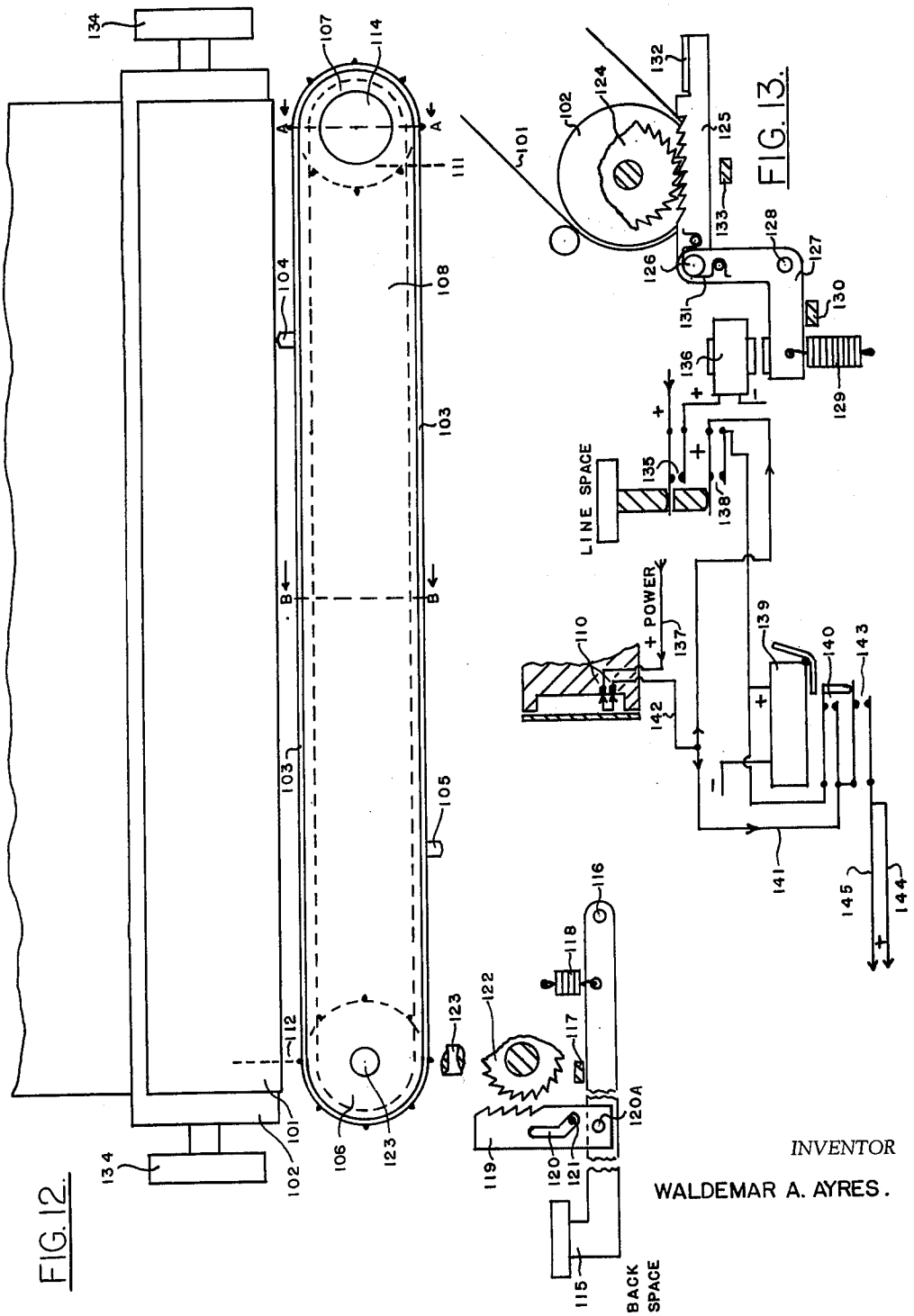

FIG. 12.

FIG. 13.

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Dec. 28, 1965 W. A. AYRES 3,225,883
WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS
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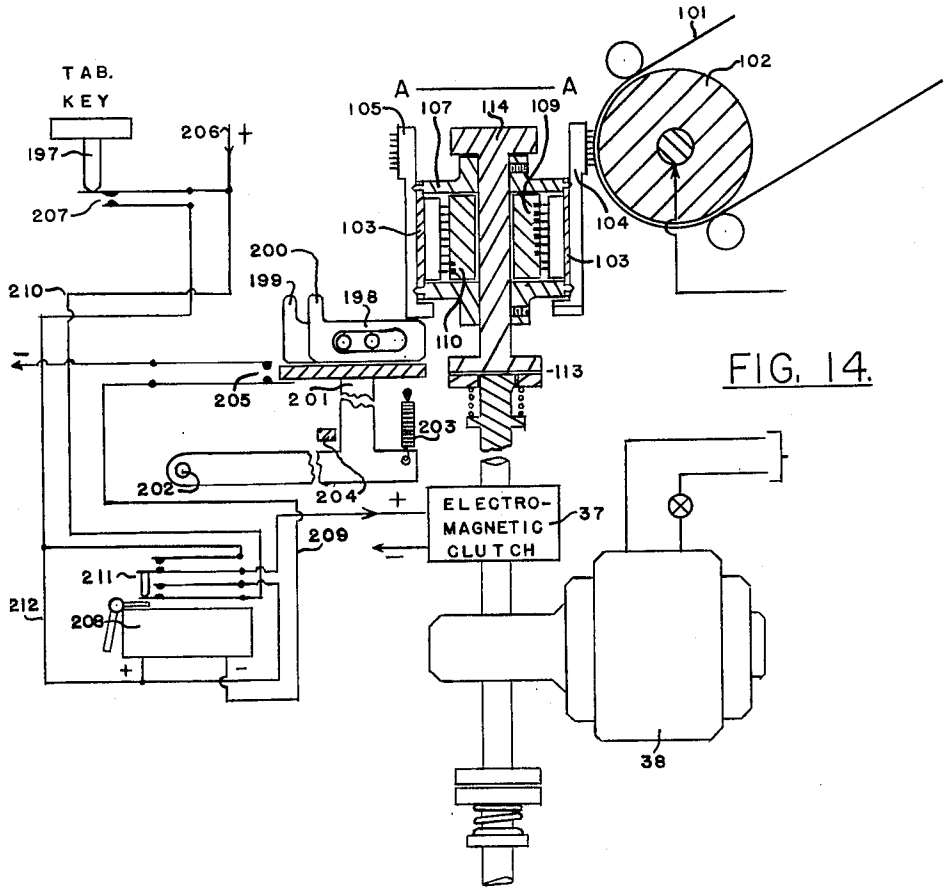

FIG. 14.

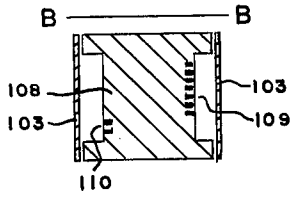

FIG. 15.

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WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS
Filed Nov. 13, 1962 9 Sheets-Sheet 9

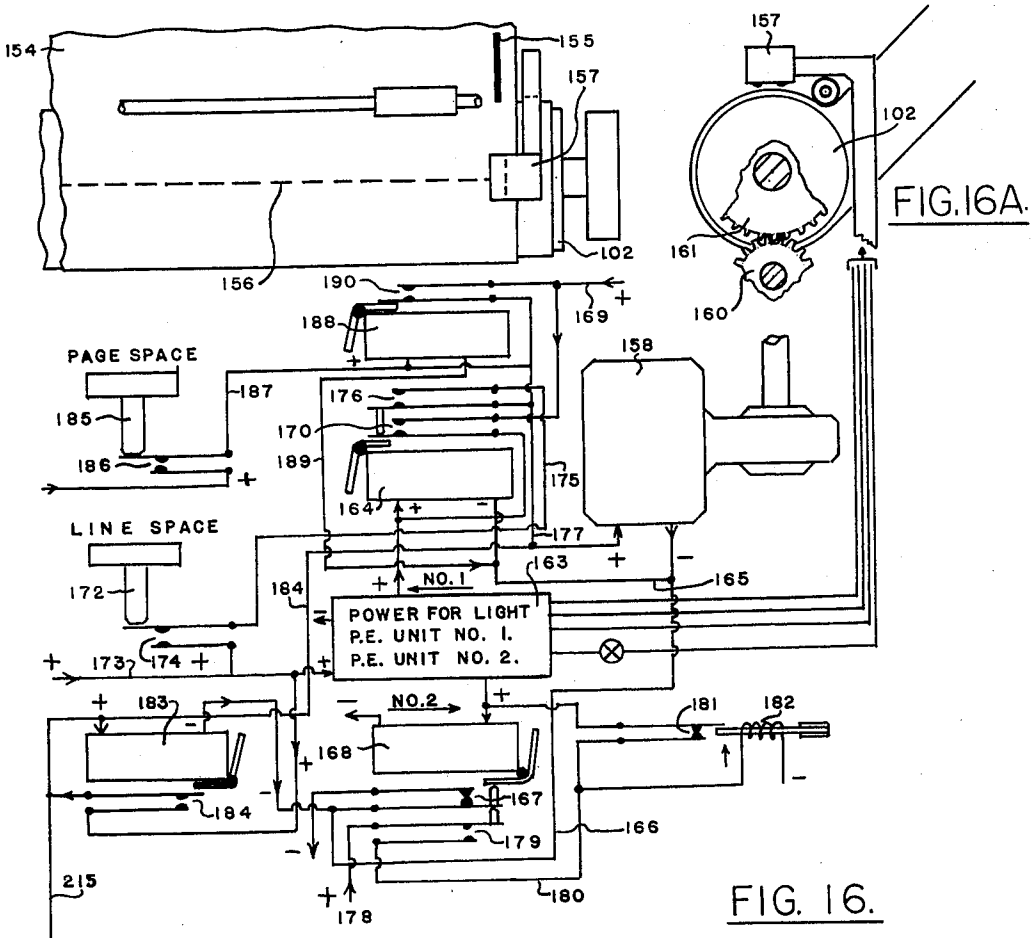

FIG. 16A.

FIG. 16.

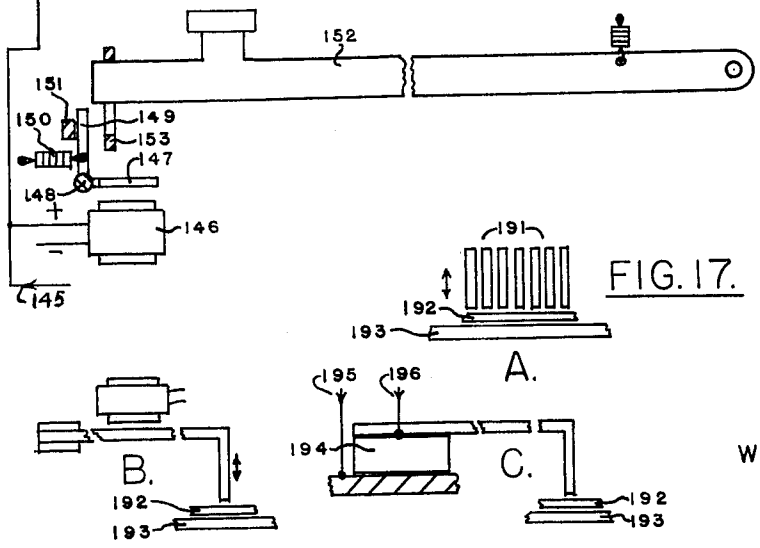

FIG. 17.

INVENTOR.

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United States Patent Office

3,225,883

Patented Dec. 28, 1965

3,225,883

WORD WRITING MACHINE PRODUCING CLOSED-UP PRINTING IN RESPONSE TO SIMULTANEOUS ACTUATION OF KEYS

Waldemar A. Ayres, 401 Park Ave., Rutherford, N.J.

Filed Nov. 13, 1962, Ser. No. 237,144

17 Claims. (Cl. 197—11)

This invention relates to improvements in methods and apparatus for key operated word printing machines capable of producing printed records of spoken words at commercial dictation speeds, with full normal spelling —no shorthand code, no phonetics, no abbreviations— readable by every normal literate person with no training in shorthand—and with various forms of this invention adapted to and particularly useful in the fields of stenography, or as high speed office transcription machines (where typewriters are usually used), news printers (as in brokerage offices), "teletype" wire communications, radio controlled printers, and the recording of text material in code form capable of controlling machine equipment, such as accounting machines, computers, transmitters, etc. This invention also relates to improvements in methods and apparatus for making normally spelled directly readable records of spoken or written languages generally, but for the purposes of illustration, their use in connection with the English language will be discussed in detail, it being understood however that this is not limiting, and that applications of these principles to all appropriate languages are within the scope of this invention also.

I have spent years studying the history, principles, and methods of shorthand and the requirements of stenography, the transcription of text material, bookkeeping and accounting work involving these same problems, and written communication involving key operated machines including news printers, wire operated typewriters, radio typewriters, etc.

The importance of the "speech-to-text-process" is shown by the fact that the human race has been trying to develop stenography since 63 B.C., when Marcus Tullius Tiro invented his system of "notae" and took down Cicero's orations; over 1000 shorthand systems have been devised for English alone, but our best systems today, Gregg and Stenotype, leave much to be desired. This invention is specifically designed to provide improvements over Gregg and Stenotype, and also provide improved speed as compared with typewriters, and communication machines based on, or similar to typewriters.

Fundamental, in this invention, has been the development of a very efficient and scientific keyboard design, based on rigorous and extensive statistical analysis of the kinds of letter combinations and their frequencies of use in the English language as we employ it in everyday affairs. This analysis also included studies of the factors involved in designing "touch systems," including the relative dexterity of each of the fingers of the two hands, and also the psychological principles relating to our habit patterns, learning processes, and the associative responses of our minds to words in the controlling of our hands.

This keyboard design eliminates any shorthand "code," phonetics, or abbreviations, so that the text is printed with all the letters of the alphabet and with normal spelling so that it is instantly readable by anyone. This is a great advance over Gregg, Pitman, Stenotype or other usual forms of stenography, where persons without special training are utterly unable to read stenographic records, and where, with only rare exceptions, even trained stenographers cannot read each other's notes. This "straight English" printed stenographic record is far more useful and valuable in business, industry, government

etc., than any "coded" stenography. The potential time and dollar savings from this factor alone are very great. Such stenography also is *far* easier to learn, than Gregg or Stenotype.

An important principle of this keyboard is that simultaneous fingering is utilized instead of sequential fingering as on a typewriter. A group of keys is provided at the left for initial consonants and consonant combinations. A group of keys to the right of the initial consonants are intermediate vowels. Farther to the right are keys for final consonants and consonant combinations, plus final "e." All of these keys could be operated simultaneously (in contrast to a typewriter where the keys *must* be operated sequentially or the machine will jam). However, the operation method is that one character may be selected from each vertical column of 5 characters from left to right across the keyboard, skipping columns not containing desired characters for the particular word being written. This left to right sequence across the board is a very important psychological principle because it directly ties in with the ingrained habit patterns of our whole lifetime, developed and reinforced by every word we have read and every word we have written. This keyboard, utilizing this psychological principle, is thereby much superior to all typewriter keyboards, linotype keyboards, stenotype keyboards, and any other keyboard where the sequence of character selection does not progress continuously from left to right matching our long established reading and writing habits.

By selecting these initial consonants, intermediate vowels and final consonants, with one finger selecting each character, whole words may be printed with one stroke of the keys—whole words, theoretically up to and including ten letters long with the ten fingers of the two hands. This simultaneous operation of the keys is a *fundamental* factor in the high speed of these machines.

Statistical studies already made have shown that this keyboard will readily be operable at speeds suitable for commerical dictation work, even though writing out the English language with full normal spelling, readable by everyone. Now, you will be able to ask your secretary for her dictation tape, and you can read it immediately as a first draft, making any corrections, improvements in wording, or insertions, by writing notes on the tape, including writing on the back. Moreover, *any* typist can type it (without tying up the time of your more expensive private secretary), or a large volume of your work can be typed by several typists simultaneously, because they, for the first time, can *all* read your secretary's dictation record—everybody can read it. Informal notes, or interoffice memos can be sent "as is," skipping entirely the delays and costs of transcription, if desired.

The principles of this invention have been applied to three different forms of machines, a horizontally moving tape printer, a vertically moving wider tape printer, and a wide sheet printer for 8½" by 11" sheets, legal sizes, and fan-fold paper and continuous forms.

An extremely limiting shortcoming of earlier simultaneous key-operated stenographic machines has been that they print with random gaps *between* letters of the same word in nearly every word printed. A major advance in the art contributed by this invention is closing up the printing toward the left so that all such gaps are eliminated, and the resulting printed words are the same, in this respect, as provided by typewriters, news printers, teletype, etc., with far greater fields of usefulness for stenographic records than ever attainable heretofore.

The terms "contiguous" or "adjoining" are used hereafter in this specification and in the claims to specifically mean character print positions which are closed up, right next to each other, with *no* gaps between letters of the

same word, to distinguish this invention from the prior art where such gaps are prevalent, extremely undesirable, and flatly *prevent* the use of such printed records in many very broad and important commercial fields.

Next, the transcription of text can be done, on this machine, with far fewer operations than on the typewriter. Not only can most words be written in a single stroke of the keys, but also in all these cases the space following the word can be included in the same stroke. Also, a comma or period can be printed by the same stroke as the word. The dramatic reduction of strokes in operating this keyboard as compared with the typewriter, news printer or teletype, etc., is illustrated by examples from the statistical studies made in the course of developing this invention. The "frequencies" used are the frequency with which we use a particular word in everyday speech and writing per 100,000 words of text, as an average.

The three most frequently used words in English are contrasted in the following tables which show the number of strokes per word as written on the standard typewriter as compared with the same words written on the word writers of this invention:

Word	Frequency of Use	Strokes on Typewriter Plus Space	Strokes by Wordwriter Plus Space
the	7,310	29,240	7,310
of	3,998	12,004	3,998
and	3,280	13,120	3,280

Examples of longer 1-stroke words:

Word	Frequency of Use	Strokes on Typewriter Plus Space	Strokes by Wordwriter Plus Space
people	163	1,141	163
should	118	826	118
through	78	624	78
though	67	536	67

Examples of 2-stroke words:

Word	Frequency of Use	Strokes on Typewriter Plus Space	Strokes by Wordwriter Plus Space
be-fore	139	973	278
be-cause	108	864	216
coun-try	92	736	184
with-out	70	560	140
state-ment	38	380	76

Examples of 3-stroke words:

Word	Frequency of Use	Strokes on Typewriter Plus Space	Strokes by Wordwriter Plus Space
an-oth-er	58	464	174
con-di-tions	38	418	114
them-sel-ves	34	374	102
yes-ter-day	33	330	99

Examples of long single stroke words plus space:

Word	Strokes by Typewriter	Strokes by Word Writer
friends	8	1
strange	8	1
pleases	8	1
straight	9	1

From the preceding examples, it is evident that the *method* of using in combination simultaneous fingering, initial consonants, intermediate vowels and final consonants in a very efficient scientifically designed keyboard for writing straight English normally spelled, and printing mechanism capable of printing characters closed up together in adjoining character positions without gaps between letters of the same word, is a very important and widely useful advance in the arts of stenography, transcription machines corresponding to the typewriter, and communication machines corresponding to news printers, teletypes, etc.

Also, as will be explained later, printing methods and mechanisms have been invented here which are both high speed and silent.

For handling numbers, three alternative methods are provided. The simplest, from the standpoint of keyboard and printer construction, is to spell out the digits. Each of these from 0–9 inclusive can be recorded with a single stroke of the keys, if zero is designated as "oh," as in "six oh three" (603), which is the way we normally *say* zero as part of a number. The one exception is seven (written sev-en) which takes 2 strokes.

As an alternative, shown in dotted lines and dotted characters in conjunction with the keyboard of FIG. 1, an optional set of keys for selecting the digits 0–9 are provided along with an optional space bar for these digits. These optional digit keys would be operated by the index finger of the left hand (for 1–5) and the right hand (6–0), utilizing the advantage that the index fingers are the most dextrous fingers of the hands. Also either index finger can operate the optional digit space bar along with selecting a digit, or separately. Simultaneous selection of numbers 0–999 will be explained later in connection with the "Shift" keyboard.

The "Objects" of this invention are listed as follows, it being emphasized that these objects are to be employed either individually or in any useful combination.

OBJECTS

An important object of this invention is to provide a key operated printing machine capable of printing at dictation speeds, producing words normally spelled, including all the letters of the alphabet.

Another object of this invention is to provide a key board of control keys for a printing machine with said keys in groups adapted to enable initial consonants to be printed by operation of fingers of the left hand, intermediate vowels to be operated by the thumbs, and final consonants plus final "e" to be printed by operation of keys by the fingers of the right hand.

Another object of this invention is to provide a key board of control keys and printing mechanism adapted for simultaneous operation of selected keys whereby full words may be printed by a single simultaneous stroke of the keys.

Another object of the invention is to provide a scientifically designed keyboard so efficient that approximately two-thirds of the words to be written in consecutive written or spoken text can be printed by the operation of this keyboard by a single simultaneous stroke of selected keys for each such word printed.

Another object of the invention is to provide a keyboard so efficient that whole words plus the spaces to follow such words can be obtained by a single operating stroke of the keys of the key board for each such word and space.

Another object of this invention is to provide a keyboard psychologically matching our long established reading and writing habits of progression from left to right whereby the operator of said keyboard can select any one character of a left hand vertical column of keys, plus any one character of the vertical column next to the right, and so on across the keyboard toward the right, also skipping any columns of keys not desired, and although all selected keys are operated simultaneously the printing mechanism will print the selected characters in a continuous sequence reading from left to right in accordance with normal writing and spelling practices.

Another object of this invention is to provide a key operated printing machine utilizing a keyboard whereby

each finger can control the selection and printing of one character so that the ten fingers of the two hands may be used for the selection of as many characters as desired up to and including ten characters printed by a single simultaneous operation or stroke of the keys.

Another object of this invention is to provide a key operated printing machine having a predetermined printing sequence from left to right on a record sheet if all keys were operated simultaneously, but that when unwanted characters are omitted in the selection of characters for printing a word no spaces will be left between the characters which are printed, such spaces being eliminated by automatic means adapted to close up the gaps by causing characters to be printed in the first available character spaces next adjoining a character located on its left, but with spaces between complete words.

Another object of the invention is to provide a printing machine having one group of control keys for initial consonants, another group of control keys for vowels, and another group for final consonants whereby words may be printed in full as normally spelled, said printing machine also having means whereby the letters of the words printed are in adjoining locations from left to right without any gaps between, thus eliminating a common and undesirable characteristic of various earlier stenographic printing machines.

Another object of the invention is to provide a printing machine controlled by simultaneous operation of keys whereby desired characters may be selected on a basis of only one finger being required to select each character while unwanted characters are skipped, and said printing machine including means to close up any spaces corresponding to such skipped characters, so that all the selected letters for a word are printed in adjoining letter positions from left to right without any spaces between letters of the same word.

Another object of the invention is to provide additional characters by providing a shift control key as an alternative control key on the keyboard, thereby providing both upper and lower case letters, or additional punctuation marks or special characters. Two shifts may be used, if desired, for substantially tripling the character capacity of the keyboard, while further extension of the same principles which will be later shown and described for one shift will triple the character capacity of the printing mechanism also.

Another object of the invention is to provide the new and useful combination of a back space with a printing machine controlled by simultaneous operation of selected initial consonant keys, vowel keys, and final consonant keys in said printing machine which records all the characters of a word in adjoining spaces without any gaps between letters.

Another object of the invention is to provide the new and useful combination of a tabular key, for indenting for the beginning of paragraphs, for recording data in columns, for filling out forms, etc., in a printing machine controlled by simultaneous operation of keys where each finger can select a character, and where said machine prints the selected characters in adjoining positions from left to right without any gaps between letters of the same word.

Another object of the invention is to provide the new and useful combination of a line space key to control vertical paper feed in a printing machine adapted to print more than one fully spelled word on the same line and where said printing machine is of the type controlled by the simultaneous operation of character selection keys.

Another object of the invention is to provide a keyboard for a printing machine whereby the digits of two or three place numbers, for example any number from 0 to 999, can be selected and printed in a single stroke.

As in the previous object, including selecting and printing the dollar sign ($) ahead of the selected digits in the same operating stroke.

As in either of the two preceding objects including simultaneously selecting and printing either a comma, or a period used as a decimal point, following the digits. For example, my keyboard is so efficient in writing numbers that the operator can select and print any of the following in a single stroke: 0 to 999 inclusive; $1.; $999. and the comma may be used for printing numbers in the thousands in only two strokes: $927,642.

Another object of the invention is providing the capability of selecting and printing up to three digit numbers followed by either a % sign or the cents sign ¢.

Another object of the invention is providing the new and useful combination of enabling short finger reaches desirable in a touch system by utilizing the method and means of selecting any one of five characters in a group of 3 keys by operation of any of the 3 keys individually, and by operating these three keys also as two different pairs, any of these 5 characters being adapted for selection by a single finger, in combination with a printing machine adapted to print whole words normally spelled with letters in adjoining print positions without any gap between letters of the same word.

Another object of the invention is the provision of contact members and circuitry actuated by any one or combination of three keys operated by a single finger whereby the desired 1 of 5 possible characters is selected and a corresponding circuit is energized and adapted to cause associated mechanism to print the character selected.

Another object of the invention is to provide the new and useful combination of a word space key control in a printing machine adapted to print more than one word on the same line, said printing machine being controlled by simultaneously operated keys adapted so as to require only one finger to select each character to print whole words normally spelled.

Another object of the invention is to provide in a simultaneous key-operated printing mechanism a master set of characters, means to sense which of these has been selected by operation of the keyboard and in what intended sequence from left to right, and means to reproduce the selected characters on a record sheet in that same sequence and in adjoining spaces from left to right while at the same time eliminating any gaps corresponding to characters not selected for the same word.

Another object of the invention is to provide a simultaneous key-operated printing machine adapted to print whole words normally spelled on a tape moving horizontally from right to left.

Another object of the invention is to provide a simultaneous key-operated printing machine adapted to print whole words normally spelled, with code indicia (capable of controlling other mechanical equipment, such as word printers, bookkeeping or accounting machines, computers, automatic machine tools, etc.) recorded along with words or numbers or recorded separately, such coding may be visible spots, invisible spots, magnetized areas, areas having different electrical, thermal, or light conductivity, areas having different coefficient of friction for control purposes (see my U.S. Patent 2,493,848 and others) and so forth.

Another object of the invention is to provide, in simultaneous key-operated power driven printing machines, means whereby only one set of selected characters are printed even though the operator may hold down the control keys for a time equivalent to more than one operating cycle of the printer, thereby preventing repetitive printing.

Another object of the invention, particularly for use in the field of stenography, although not limited thereto, is providing a *vertically* moving record sheet machine adapted to normally have one complete word on a line, fully spelled, even though such a word may have required more than one stroke of the keys for its completion, and controlled by a simultaneously operated keyboard, and

with the letters of a word printed in adjoining character spaces without gaps between letters of the same word.

Another object of the invention is to provide another alternative form of the machine adapted to print on standard wide sheets, such as 8½" by 11", and legal sizes, and controlled by simultaneously operated character keys and adapted to print words normally spelled, with the characters printed in adjoining character positions without gaps between letters of the same word.

Another object of the invention is to provide, in a simultaneous key-operated machine, a plurality of printing means used alternatively so that the waiting time between ending one line and starting the next, corresponding to the "carriage return" in a typewriter, is eliminated; when one line is finished, another printing element is adjacent to and available for printing the next line.

Another object of the invention is to provide, in a simultaneously operated key-controlled printer, particularly where wide paper is employed, means adapted for the use of fanfold paper, or paper in rolls or continuous forms, etc., intended to be divided into separate sheets later of predetermined length, control means for the vertical paper feed whereby after the printing of a bottom line, the sheet is automatically fed vertically by an amount providing a standard bottom margin for that page, plus a standard top margin for the next page, above and below a predetermined sheet separation line, usually preprinted on the paper, or perforated, or both.

Another object of the invention is to provide a "Page Space" control key, particularly for the form of machine referred to in the previous object, whereby when printing for a given page or form has been completed at any height on the page intermediate between the top and bottom print line positions, this "Page Space" Control Key may be operated and the machine will automatically feed the paper upward for the rest of that page and automatically stop at the first line print position on the next page.

Another object of the invention (particularly related to the above two objects) is to provide automatic means adapted to prevent operation of the character selection keys of the keyboard while the paper is being fed vertically.

Another object of the invention is to provide very high speed marking means, including types reported to be substantially instantaneous, in the forming of record characters so that high overall operating speeds are obtained for stenography, for increased production efficiency in transcription, and for increased efficiency in written communication.

Another object of the invention is to provide the new and useful combination of a simultaneous key-operated printer adapted to print whole words at a stroke in adjoining character positions on a record sheet and printing means which are silent in operation, thereby greatly aiding the concentration of a person dictating, by eliminating the distraction of machine noise when recording the discussion of a meeting, or eliminating the noise, nerve strain, fatigue, and loss of efficiency when used for transcription work generally in various office activities or eliminating the distracting racket of one or a battery of teletype machines, or other communication machines.

Other objects and advantages of the invention will be apparent during the course of the following description and drawings in which like numerals are employed to designate like parts throughout.

Note that not all parts of the drawings are necessarily to the same scale, and diagrammatic presentation is used extensively, it being deemed that simplicity and clarity are of maximum importance in showing the principles of this invention.

In the accompanying drawings:

FIGURE 1 shows a diagrammatic plan view of the basic keyboard used in this invention, although other control keys are to be added for special purposes in various forms of the machine, as will be described later. The dotted keys and dotted characters indicate optional digit keys and space bar.

FIGURE 2 shows a diagrammatic plan view of an alternative keyboard where a shift control provides additional characters, and the printer control keys "tabulation" and "back space" and a "page control" for fanfold, etc., are added.

FIGURE 3 is a circuit diagram showing how contacts under each vertical row of three keys select and energize the one of the five character circuits of that group of vertical keys operated.

FIGURE 4 is a circuit diagram and fragmentary showing to a cylinder of master characters spread out, with horizontal space feed controls, feeding means, and printing head for the horizontal tape printer. An optional slave printer for making multiple copies is also shown.

FIGURE 5 is a combined fragmentary vertical section and diagrammatic showing of the cylinder of master characters of FIGURE 4, and with its set of rotating brushes.

FIGURE 6 is a diagrammatic side elevation showing a typical character key and single revolution clutch to prevent repeated printing of a character if a character key is held down longer than one operating cycle.

FIGURE 7 is a diagrammatic fragmentary showing of how the cylinder of master characters is modified with a keyboard having a "shift" control to approximately double the number of characters obtainable.

FIGURE 8 is a diagrammatic showing of another form of the invention providing the recording of a combinational code suitable for controlling other machine equipment.

FIGURE 9 is a fragmentary diagrammatic side elevation, partly in section, of a code recording head for magnetically recording the code of FIGURE 8.

FIGURE 10 is a circuit diagram with a fragmentary section of record tape showing how associated equipment can be directly controlled in addition to recording the characters and code as shown.

FIGURE 11 is a circuit diagram and fragmentary diagrammatic showing of an alternative form of the invention for producing a vertically moving record tape normally having one complete word on each line, even if that word requires more than one stroke of the keys of the keyboard.

FIGURE 12 is a fragmentary diagrammatic plan view showing another form of this invention to provide a printer for wide sheets such as 8½" by 11", legal sizes, etc., and also shows "Back Space" mechanism.

FIGURE 13 is a circuitry and a fragmentary diagrammatic showing, partly in section, of "Line Space" mechanism.

FIGURE 14 is circuitry and a fragmentary diagrammatic showing of portions of the wide sheet printer (8½" by 11") including the "Tabulating Key" control, with settable tab stops, and also including a vertical cross section taken along the line A—A of FIGURE 12, looking in the direction of the arrows.

FIGURE 15 is a vertical cross section of FIGURE 12 taken along the line B—B and looking in the direction of the arrows.

FIGURE 16 is a fragmentary diagrammatic showing, with circuitry, of another form of the invention providing automatic vertical paper feeding means for the bottom margin of one page plus the top margin of the next page in fan fold paper, roll paper and continuous forms, together with a manually operable "Page Space" control; and keyboard locking means automatically operated while the paper is being fed vertically.

FIGURE 16A is a diagrammatic fragmentary end elevation showing the right end of the platen, the sheet of paper being printed upon, and the photoelectric unit adapted to sense the registration mark on fan fold or roll paper and adapted to control the automatic positioning of successive pages of paper, as will be described later.

FIGURE 17A is a diagrammatic fragmentary end

elevation of character marking means alternative to that shown throughout the preceding figures. FIGURE 17B is a fragmentary diagrammatic side elevation showing an electromagnetic type of alternative marking means such as shown in FIGURE 17A. FIGURE 17C is a fragmentary diagrammatic side elevation of a piezoelectric type of alternative marking means, such as shown in FIGURE 17A.

Referring now to the drawings:

In FIGURE 1, a keyboard is shown having vertical columns of keys of three keys each. Any one of the five characters shown in a given column can be selected with a single finger. For example, in the second column from the left, depressing the top key would select the character "V"; moving the finger down so that top and middle keys are depressed simultaneously would select "W"; depressing the middle key alone would select "S"; depressing the middle key and the lower key would select "J"; and depressing the lower key alone would select "Q." The same method of character selection in each vertical column applies from left to right across the keyboard. The "home position" of each hand for operation by the "touch system" is preferably as follows: For the left hand, the little finger is placed on "S"; the fourth finger on "T"; the third finger on "H"; the index finger on "R"; and the thumb on "E." For the right hand, the thumb on "E"; the index finger on "R"; the second finger on "N"; the third finger on "D"; and the little finger on "E." The little fingers of the two hands will reach outwardly to operate keys in the first and last columns respectively as needed, while either thumb will operate the space bar between the vowels. When operated, this space will occur on the right of the character printed farthest to the right during the same stroke of the keys. The printing sequence, from left to right, of characters selected simultaneously is from left to right by columns across the board, starting with column No. 1 on the extreme left and ending wtih column No. 12, skipping any column where no key is operated. The printing mechanism automatically closes up the printing toward the left so that any columns not operated do not leave a gap in the printing, by methods and mechanism which will be explained later.

Complete words plus the space following the word can be written at a single simultaneous downward stroke of the keys, as shown by the examples which follow:

"SPEED"—"S" in Column 2; "P" in Column 4; "E" in Column 6; "E" and "space" in Column 7; "D" in Column 10. "CUTS"—"C" in Column 3; "U" in Column 6; "space" with either thumb; "T" in Column 10; "S" in Column 12. "COSTS"—"C" in Column 3; "O" and "space" in Column 6 (left thumb); "S" in Column 9; "T" in Column 10; "S" in Column 12. Where a word requires more than one stroke, it is written by syllables or in accordance with the operator's preferences, using the "space" bar only with the last stroke to provide the space between words. Or, where needed, the operator would use the comma, or end the sentence with a period. With machines using the keyboard of FIGURE 1, numerals are spelled out.

As explained earlier, the dotted keys and characters indicate a set of optional digit keys and digit space bar when it may be preferred to supply digit keys rather than spell out digits, primarily on keyboards not including the "shift." The same principles of the invention would be utilized in adding these optional digit keys and space bar as are discussed fully elsewhere, for both the keyboard and the printing mechanism. Note that all the letters of the alphabet are on the keyboard so every word can be spelled out in full.

In FIGURE 2, a more elaborate keyboard is shown where a "shift key" takes the place of Column 1 of the first keyboard and the number of characters available is nearly doubled. These "shift" characters are shown by the small characters located in the small areas on the keyboard diagram. Note that three full sets of digits from 0 through 9 are provided with a $ sign preceding them in the printing sequence and with a comma, a period useable as a decimal point, % sign and ¢ mark following the digits in the printing sequence, so that combinations of these numerals and signs can be printed very efficiently. Any other characters, if preferred, could be put on the "shift" keyboard, or a second "shift" control could be added, substantially tripling the characters available. If desired, lower case letters could be printed without the "shift" and capitals with the "shift." However, for all stenography and for a very large amount of wire communications such as news printers, printing telegraphs (Western Union) and teletype, capitals without lower case are fully acceptable. Keeping keyboards as simple as possible is very desirable, so that the use of capitals alone is recommended. With this, the keyboard of FIGURE 2 will meet very well all ordinary needs, while the keyboard of FIGURE 1 provides a still simpler one, if desired.

In describing the construction and operation of the different forms shown of this invention, the horizontal tape printer will be discussed first, and in turn the vertical tape printer, then the wide sheet printer (such as 8½" by 11" pages), and then the fanfold printer. Each of these latter forms of printer is easily understood by discussing only wherein each differs from the preceding forms of the invention.

In FIGURE 3, which shows the keys of FIGURE 1 diagrammatically, sets of contacts and associated circuitry are shown for selecting the one character of the 5 characters available in each column of keys. The circuitry for Column 1, which is in the upper left column of FIGURE 1, will be traced. All the other columns are exactly the same. Also the energizing of the spacing circuit will be traced, as well as the "word space" key.

In all the circuitry in this patent the convention is followed of labelling leads plus (+) which connect power to units operated (such as magnets, relays, motors, clutches, etc.) and labeling return circuits minus (—) as this is a distinct aid in visualizing and comprehending the operation of the circuits, but this is not to be considered limiting or indicating that alternating current or reverse polarity D.C. could not be used if desired.

In FIGURE 3, the power lead **20** is connected to the lead **21**, which is connected to the center contact of the group of contacts under the center character key. The upper contact of this group is connected to both the second contact from the top under the right hand character key and to the second contact from the top of the contacts under the left hand character key. The lowest contact under the center character key is connected to the fourth contact from the top under the left hand character key. The top contact under the right hand character key is connected to the outgoing lead **23** to energize the circuit to cause printing of the character selected by depressing the right hand key alone, in this case the apostrophe ('). The third contact from the top under the right hand character key is connected to the outgoing lead **25** to energize the circuit to cause printing of the character selected by depressing the center key only, in this case the quotation mark ("). The fourth contact under the right hand character key is connected to the third contact from the top under the left hand character key. The fifth contact from the top under the right hand character key is connected to the outgoing lead **24** to energize the circuit to cause printing of the character selected by depressing the right hand and center character keys simultaneously, in this case the beginning parenthesis mark—(. The top contact under the left hand character key is connected to the outgoing lead **27** to energize the circuit to cause the printing of the character selected by depressing the left hand key alone, in this case the question mark (?). The bottom contact under the left hand character key is connected to the outgoing lead **26** to energize the

circuit to cause the printing of the character selected when the center character key and the left hand key are depressed simultaneously, in this case the closing parenthesis mark—). **28—28** is a common bar or plate which is moved downwardly when any of the keys in this column of keys is depressed, in order to control spacing of the paper tape for the character selected by operation of keys in this column. Each column of keys has its own separate common bar or plate, as shown. The downward movement of plate **28** closes the contacts **29** thereby connecting power from lead **20** to the outgoing lead **22** which will cause feeding of the horizontal record tape for the character selected in Column 1.

In FIGURE 3, the operation of the keys and circuitry is as follows: When the right hand character key is depressed alone, power flows from power lead **20**, through lead **21** to the second from the top of the contacts under the center key, through the top contact under that key to the contact second from the top under the right hand key, through the top contact under that key and through the outgoing lead **23**. When the center key and the right hand key are depressed together current flows from plus power lead **20**, through lead **21** to the center contact under the center key, through the lowest contact under that key to the fourth contact from the top under the left hand key, through the third contact under that key to the fourth contact from the top under the right hand key, through the lowest contact under that key and through the outgoing lead **24**. When the center key is depressed alone plus current flows from power lead **20**, through lead **21** to the second contact from the top under the center key, through the lowest contact under that key to the fourth contact from the top under the left hand key, through the third contact from the top under that key to the fourth contact from the top under the right hand key, and through the third contact from the top under that key to the outgoing lead **25**. When the center key and the left hand key are depressed together current flows from plus power lead **20**, through lead **21** to the second contact from the top under the center key, through the third contact from the top under that key to the fourth contact from the top under the left hand key, through the lowest contact under that key through the outgoing lead **26**. When the left key is depressed alone current flows from plus power lead **20**, through lead **21** to the second contact from the top under the center key, through the upper contact under that key to the second contact from the top under the left hand key, through the top contact under that key to the outgoing circuit **27**. The depressing of any of the character keys in Column 1 closes contacts **29** so that plus current from power lead **20** flows through the outgoing lead **22** labeled "SP" (space). All the other groups of three keys arranged in vertical columns on the keyboard (but in horizontal groups in the circuit diagram FIGURE 3) (see the character labeling which identifies each key and key combination in the keyboard diagrams and in the circuit diagram of FIGURE 3) operate in the same manner. When the "Word Space" key in FIGURE 3 (labelled "Space" in FIGURE 1) is depressed closing contacts **30**, plus current flows from the power lead **20** through contacts **30**, and through the outgoing lead **31**, which will cause the horizontal record tape to be moved a character space to the left without printing any character in that space, as will be explained later. Note in FIGURE 3 that each group of outgoing leads from the character selection keys is labeled by column numbers which correspond to matching labeling of incoming leads where these are connected in FIGURE 4. The circuitry of FIG. 3 forms character connecting means which serve to energize the master characters corresponding to the actuated keys.

FIGURE 4 is a diagrammatic showing of the methods, circuitry and mechanism of the horizontal tape printer. Part of the mechanism for this is shown in FIGURES 5 and 6.

In FIGURE 4, the upper portion of the diagram spread out from left to right (not to scale) and designated generally as **32**, is the cylindrical surface shown in vertical section (with the brush circuitry shown diagrammatically) in FIGURE 5. This mechanism broadly is a commutator and brushes combination. The commutator **32** forms a sequence means. In this case it is simpler to have the commutator a hollow fixed cylinder with the brushes rotating, than to follow the usual arrangement of having fixed brushes with the commutator rotating. The outgoing leads from the keyboard keys and circuitry are led up through the mounting plate **33** of FIGURE 5, and are internally connected, through the cross section of the cylindrical commutator, which is insulating material, to each corresponding character or space segment, which is made of electrically conductive material, on the outer surface of the cylindrical commutator. The brushes, when rotated as a group, will sweep across these conductive character and space segment surfaces "scanning" each column of characters successively. Only one character area in any column will be energized at a time and only those character space segments will be actuated in columns where character areas are energized. The "Word Space" segment **34** in FIGURE 4 will be energized only when the (Word) "Space" key of the keyboard is depressed. The above described action is readily understood by visualizing the vertical row of brushes (generally designated as **35A** in FIGURE 4) as moving from their initial starting position, as shown, toward the right, across each column of conductive character segments, including that column's space segment, and finally across the "Word Space" segment at the extreme right. Note that the moving brush which passes over the space segments encounters each space segment slightly before any of the character segments in the respective columns is contracted. When an energized space segment is encountered, and for the duration of such contact, current flows through this brush, along lead **36**, to the electromagnetic clutch **37**. This current clutches in the rotation of motor **38** (which runs continuously while the machine is in use) with appropriate paper feed means (shafting and driving pulley), shown generally as **39—39** to feed the record tape **40** toward the left. I have inquired of manufacturers of electromagnetic clutches, in connection with this invention, and they assure me that they already make units which clutch to full speed or declutch to stop in 5 one-thousandths of a second, so it is evident that paper feeding, or other electromagnetic clutch actions in this invention can be very high speed indeed. The drive pulley can have sprockets and the tape can have matching sprocket holes, if desired. The tape record **40** is treated "facsimile" paper or electrosensitive paper well known to the art, where passage of electricity there-through electrochemically (or by other means) produces a contrasting visible mark. Experts in this field have assured me that this marking is substantially instantaneous—requiring approximately zero time. Here again, I am employing printing means of very high speed capability. This printing also is *silent* in operation.

A slave printer for making a plurality of records of the text simultaneously is shown at the lower right of FIGURE 4. This principle of using multiple printing heads and record feeding means to produce a plurality of records simultaneously can be used on the vertical tape printer and on the wide sheet printers of this invention also.

FIGURE 6 shows means to prevent repetitive printing in case an operator holds down one or more keys a time greater than that equivalent to one operating cycle. This mechanism also automatically starts the brush group **35A** always from the same starting position and assures that these brushes start "scanning" intantly when the character keys have been depressed by a predetermined amount chosen as optimum for starting the printing cycle. In FIGURE 6, **41** represents the driven portion of a single revolution clutch rotated by shaft **42** (see FIGURE 4).

41 is normally prevented from rotating by its arm portion 43 abutting against the stop portion 44 of the common bail lever 45. Lever 45 is pivoted at 46 and is pulled in a clockwise direction about pivot 46 by spring 47 against stop 48. The rod portion 49 extends across under all the character keys and space key. At the right hand end of the common bail lever 45, the pivoted toothed rack member 50 engages the idler spur gear 51, which in turn engages the toothed rack member 52, which is slidably mounted to move in and out along a radius of the rotatable member 41, as shown. The driven member 41 is connected by appropriate shafting (not shown) to rotate the rotatable brush assembly generally designated as 35–35A in FIGURE 5. The brush assembly 35A forms a sequence scanning means. This assembly is mounted on ball bearings 53 and 54 and the counterweight 55 is provided for mounting opposite the center of mass of the brushes for dynamic balancing the assembly. Such a counterweight may be precisely adjusted by making it slightly too heavy and then drilling out a little material at a time, as represented at 56—56, by well known dynamic balancing techniques routinely used in balancing motor armatures, gyroscope rotors, etc. To provide the minimum mass for the rotatable brush assembly all structural material may be cut away except that necessary for supporting the ball bearings, the brush mountings, the dynamic balancer, and the upper end surface supporting the circular slip rings 56A. Very light kinds of materials, such as magnesium, plastics, etc., may be employed to reduce the acceleration and deceleration forces required for rapid starting and stopping.

When any key bar, such as 57 (FIGURE 6), is depressed sufficiently to move the common bail lever 49 downwardly and in a counter clockwise direction about pivot 46, the rack member 50 moves upwardly causing spur gear 51 to rotate clockwise, and driving rack member 52 to move downwardly *behind* the portion 43 of 41. By the time the stop portion 44 has moved up sufficiently to disengage 43, 52 has already moved to an intercepting position. With the slip clutch continuously endeavoring to rotate 41, the moment obstruction 44 is withdrawn, 41 will rotate, carrying with it the scanning brush assembly 35–35A. The portion 43 of the single revolution clutch will be stopped by 52 and held there, in a position where the scanning brushes 35 are to the right of the word space sector 34 (see FIGURE 4) in an insulated inactive zone, until the operator lets up the keyboard keys. As these keys move upwardly, the member 45 rotates clockwise about pivot 46, bringing the stop portion 44 back into interception position with portion 43 of 41 *before* member 52, in rising, moves out of obstructing engagement with 43. By the time 45 has moved up against stop 48, portion 43 has rotated counter clockwise to its normal abutment position against stop 44. This design has the advantage that the stopping position for 41 is not critical (because the brushes 35 will be contacting an inactive area of the commutator) and the mounting (not shown) for the interceptor member 52 can be made of the yielding type to absorb impact silently.

The "scanning" brushes of assembly 35–35A will have the same relative motion from left to right across the commutator character segments as the moving record strip 40 will have relative to the marking contacts 58 bearing on the facsimile paper. Current, as picked off the energized character commutator segments, will be passed through the facsimile paper to the common contact bar 59, which is connected to the return side of the power circuit.

If it is desired to obtain more space between adjacent marking electrodes in a vertical group of marking electrodes as an aid in construction, such electrodes can be arranged in a slightly slanting row or can be staggered alternately, etc., *as long as* the corresponding scanning brushes are arranged in the same manner.

In this way the *method* is employed of providing character selection keys to simultaneously select characters from a master set of characters and to automatically reproduce these selected characters in a predetermined order of print positions from left to right on a record, including automatically closing up the print positions toward the left for print positions not selected (note that the record member 40 is fed relative to the marking elements 58 only when a column containing a selected character, or the word space, is being scanned) so that characters of the same word are printed in adjoining print positions (contiguous to each other).

FIGURE 7 shows how the commutator 32 of FIGURE 4 can be modified to accommodate the additional character capacity of the keyboard of FIGURE 2, where the additional characters are selected by operating the "shift" control 63 at the same time as the character selection keys. In FIGURE 7, the extended commutator 60 has the "shift" characters in alternate vertical columns following the non-"shift" characters, as shown in FIGURE 4, bearing in mind that in the "shift" keyboard of FIGURE 2, the "shift" control key takes the place of the character keys for the apostrophe, the beginning parenthesis, the quotation mark, the ending parenthesis, and the question mark of the FIGURE 1 keyboard, and these characters are provided among the "shift" characters, as shown in FIGURE 2. In FIGURE 7, note also the addition of the "shift" power segments 61 and the group of three brushes 62 which "scan" these shift segments. These segments 61 and the brushes 62 determine the timing of the energizing of the selected characters of the commutator 60 in order to select between non-shift and shift characters and to coordinate the spacing of the horizontal record strip 40 of FIGURE 4. In FIGURE 7, the corresponding conductive character segments for the non-shift and shift key selections are internally connected together. For example, the V and the " are internally connected; W and ((beginning parenthesis); and S and $; M and 1/4; K and 3/4, and so forth throughout the commutator 60.

In the forms of the invention utilizing the "shift" keyboard, the lead 20 of FIGURE 3 is not connected directly to plus power but instead is connected to the slip ring brush lead 64 which has its slip ring connected to the center scanning brush of the group 62 (see FIGURE 7). This may be considered as the output lead, while the scanning brushes above and below the center scanning brush of the group 62 may be considered as the input brushes, and the segments 61 act as automatic switching and timing elements to selectively energize the lead 20 of FIGURE 3.

When the scanning brush assembly 35–35A in FIGURE 7 moves from left to right across the commutator 60 and the "shift" control 63 is *not* operated, power flows from the plus supply through the center and upper contacts of shift key 63 to the lowest brush of group 62 (FIGURE 7). While the brush assembly is passing over the non-shift characters, for example V W S J Q, current flows from the energized lowest brush of group 62 through the commutator segment 61 and out through the center brush of group 62. This center brush is connected to lead 20 of FIGURE 3 which then supplies plus power to all the character key circuits, as previously explained in connection with FIGURE 3. This current then flows to the character and space segments selected by the keys operated, and these characters are printed as previously discussed. However, as soon as the scanning brushes 62 (FIGURE 7) move into a vertical column area for "shift" characters, then the circuit between the lowest brush and the center brush of group 62 is broken and no current flows to the "shift" character segments so they are not printed. Note also that although the character spacing segments 65 are the length of both the non-"shift" and "shift" characters, these segments are energized by lead 20 (FIGURE 3) only while the brushes 35A are scanning the characters being printed. In this way the record strip

is fed while the characters are being printed but not otherwise, except when the word space segment **66** is energized by operation of the word space key on the keyboard of FIGURE 2.

When the "shift" key **63** (FIGURE 7) is operated, power passes through its center and lower contacts and energizes the upper brush of the group **62**. Then, when the scanning brushes are passing over the non-shift characters, such as —VWSJQ— no current flows to the center brush of group **62**, but when the scanning brushes are passing over the "shift" characters current passes from the upper brush to the center brush of group **62** energizing lead **20** of FIGURE 3 and the selected "shift" characters are printed and the record strip **40** is fed during this printing. Note that by this simple addition of three scanning brushes, three slip rings added to the group **56A** (FIGURE 5), not shown, and three slip ring brushes added to the group **67** (not shown) and the switching segments **61** doubling of all the contacts under the character selection keys is eliminated, plus elimination of added spring loading of these keys of the double sets of contacts. Thus maximum "lightness of touch" of the keys is obtained, and 143 contacts and their connections are eliminated which otherwise would be required.

Various methods may be used for making the commutator units of master characters. One method would be to first make a hollow cylinder of insulating material such as phenolic resin, epoxy casting resin, or other preferred material. Then an engraving machine could be used to engrave the characters in their respective locations on the outside of this cylinder. Then metal could be deposited in the engraved portions to make them conductive. For example, finely powdered copper could be mixed with just enough epoxy resin to act as an adhesive and binder (but not to render it non-conductive). Fine holes could be drilled through each character area and the cylinder wall behind it for introducing and connecting wires to each character area. Then, the characters could be electroplated on their outside surfaces with hard chromium to protect from corrosion and to provide excellent wear properties. Finally the cylinder could be cylindrically ground to give a smooth and true surface for the "scanning brushes" to ride upon.

FIGURE 8 shows how the master character areas can be increased vertically to include a code of dots where it is desired to record such a code along with the letters, punctuation marks or numerals, etc. The dot code can be treated the same as the master character it represents and the two would be internally connected electrically. Sufficient additional scanning brushes would be added to reproduce the dots in addition to the letters, etc., as illustrated in FIGURE 8.

FIGURE 9 represents alternative means for magnetically recording a dot code. In this view, consider the record strip **68** as moving toward the reader. A magnetizable coating **69**, which may be magnetic iron oxide, is carried by the record strip **68** beneath the recording head, generally designated as **70**. This may consist of a group of individual electromagnets arranged across the tape transversely to the direction of movement of the tape and energized individually or in combination, to reproduce the dot code of the master characters energized as corresponding dot areas of magnetized material. Where preferred, the dot code could be recorded separately from, or without, the alpha numeric characters, although it is expected that in most situations having a control tape "interpreted" with readable characters would be preferable.

FIGURE 10 illustrates how readily the principles and circuitry of this invention lend themselves to operating communication equipment at a distance. In addition to making a readable record on the machine being key operated, the circuits can be tapped as shown to operate remote machines. Direct wire connections can be employed. Alternatively, signals from the circuits shown can be used to control tone generators so that corresponding tones in various combinations can be sent over telephones, wire lines, or by radio, with corresponding selectively responsive circuitry (such as band pass filter sections) can be employed to selectively energize facsimile or other marking means to reproduce the characters transmitted and control the record feed. The group of leads bracketed at A in FIGURE 10 may be employed if the characters alone are to be transmitted. The group of leads bracketed at B may be employed if the code alone is to be transmitted. Both the A and B leads can be used if both the characters and the code are to be transmitted.

FIGURE 11 shows diagrammatically modifications of the invention to provide a vertically moving tape. This may be particularly useful for stenography. The tape may be roll, or fanfold, which is particularly convenient to handle, as well known with the Stenotype. The printing in FIGURE 11 is normally one full word (plus comma or period) to each line, even with words which may require more than one stroke. The mechanism is shown with a 15 letter capacity per word, across the tape. Statistical studies of written and spoken English show only up to 14 letters in the basic list constituting the different words in 78% of the language as we use it regularly. If desired, the 15 letter capacity per line could be increased to 20 letters or more, using these same principles. However, any word exceeding the letter capacity provided can be continued on the next line.

Either the keyboard of FIGURE 1 or FIGURE 2 can be used with any of the printers of this invention, with the adaptations made as explained for FIGURE 2 keyboard, but for simplicity, FIGURE 1 keyboard will be used to explain the vertical tape machine.

In FIGURE 11, the printing head **71** extends all across the width of the facsimile tape **74**. This printing head **71** consists, preferably, of 7 horizontal rows of small conductors set in 5 vertical columns for each character print position, with adequate lateral space between each print position for a small space between each letter. As discussed above, a total of 15 letter positions across the tape are normally provided. These small conductors are positioned and carried in a block of insulating material. In use, the smooth front surface of this printing head contacts the electro-sensitive tape which is held in resilient pressure contact therewith by a conductive plate (not shown) behind the record sheet to provide the common return circuit for the individual marking contact elements of printing head **71**. Various paper guides, pressure rollers, etc. may be used as desired to handle the paper, the selection of the most appropriate ones of these being left to the individual preferences of persons skilled in the art who are quite familiar with them.

Leads from the marking contacts of print head **71** are mounted in an approximate semicircle, as shown at **72—72—72**. These leads, or contact areas connected to them, also are 7 rows high, forming a fixed commutator area for selectively energizing the marking contacts of print head **71**. **73** is a radial brush arm, also consisting of 7 brushes arranged vertically to sweep across and successively contact the commutator areas from left to right. When any energized brush contacts a commutator segment, the print head element connected to that segment marks a spot on the record paper. The total sum of these prints the words, as shown on record tape **74** (greatly enlarged) in FIGURE 11.

The brush arm **73** sweeps radially clockwise in the same manner that the record strip **40** of FIGURE 4 is fed from right to left. The same motor **38** (FIGURE 4), electromagnetic clutch **37**, and single revolution clutch control **41** of FIGURE 6 and static commutator with rotatable scanning brushes of FIGURE 5 and FIGURE 4 are used. In FIGURE 11, the output shaft of electromagnetic clutch **37** (FIGURE 4) is coupled to drive the radial brush arm **73**. This brush arm also carries a toothed ratchet **75**. The tension spring **76** constantly

exerts a strain tending to rotate brush arm **73** in the counter clockwise direction. The pawl member **77**, pulled by spring **78**, normally rides over the teeth of ratchet **75** and normally prevents counterwise rotation of brush arm **73**. Seven slip ring brushes and slip rings, as represented at **79**, are connected to the 7 character output slip ring brushes of group **67** (FIGURE 5) and feed selected character signals into the brush arm **73** which distributes them to the successive print positions of print head **71**. Note that the brush arm **73** is driven to the right only as characters are being printed, because only then are control spacing signals being received by electromagnetic clutch **37** (FIGURE 4). When no signal is being received by electromagnetic clutch **37**, the pawl **77** and ratchet **75** hold the brush arm **73** motionless, waiting. This automatically causes characters to be printed in adjoining (contiguous) print positions, with no gaps between letters of the same word. When a word requires more than 1 stroke, the brush arm **73** waits wherever the last selected character of the previous stroke left it, and then starts moving clockwise again as the space and character signals of the second stroke are received. This action continues until the last stroke of the word, when the "Space Key" (which on this machine is relabeled "Line Key") is operated along with the last stroke. This "Line Key" also represented by **80** in FIGURE 11, closes the additional pair of contacts **81**. This action conducts current from plus power to the electromagnets **82** and **83**. When **82** is energized it moves the angle member **84** counterclockwise about the pivot **85**. This moves the floating rack member **86** with ratchet teeth, toward the left, additionally stretching tension spring **87** and riding over the teeth of record feed roller ratchet gear **88**. The spring **89** tends to rotate the ratchet member **86** clockwise about pivot **90**, thereby maintaining the engagement between the ratchet teeth of member **86** and the ratchet gear **88**. A roller detent, well known to the typewriter art (not shown) keeps the ratchet gear **88** from reversing while the rack **86** is riding over the teeth of ratchet gear **88**. The energizing of electromagnet **83**, by the closing of contacts **81**, attracts the lever **91** toward the left. The lower end of **91** carries the floating latch member **92** by pivot **93**. The tension spring **94** tends to rotate latch **92** clockwise about pivot **93**. When magnet **83** is energized, floating link **92** is moved to the left and the latch portion at its left end moves clockwise engaging the portion **95** of pawl member **77**.

When the "Line Key" **80** is released and magnet **83** is de-energized, the stretched tension spring **96** pulls lever **91** back against its stop **97**. This moves latch member **92** back toward the right, and also pulls pawl member **77** out of engagement with ratchet **75**. Then tension spring **76** rotates brush member **73** counter clockwise until it rests against its stop **98**. This action closes contacts **99**, which conducts plus power to magnet **100**. Energizing magnet **100** moves latch member **92** counterclockwise about its pivot **93**, and this in turn releases pawl member **77** which is then pulled by tension spring **78** back into engagement with ratchet gear **75**.

When the "Line Key" **80** is released this also de-energizes Magnet **82**. The tension spring **87** pulls the ratchet rack member **86** toward the right and this action spaces the record tape vertically by one line, ready to print on the next line. The line key **80** can be operated by itself and released to space the record sheet additionally vertically, as might be done to indicate paragraphs, or for other purposes. A conventional knob (not shown) can be mounted on the paper feed roller shaft to over ride the roller detent and move the record sheet upwardly (especially for inserting the sheet).

In FIGURES 12, 13, 14 and 15 diagrammatic modifications of the invention are shown to provide a wide sheet printer for standard 8½" by 11" pages, legal sizes, etc., for regular transcription work, comparable to the office typewriter, but capable of much higher production speed, silent operation, and taking dictation directly with such a machine, where desired.

This machine eliminates the usual typewriter carriage, with the many design problems involved with accurately driving it back and forth, accelerating and decelerating its mass, etc. Instead, the paper is moved vertically only, and very light weight printing means are moved horizontally to effect the printing. The usual waiting time, corresponding to "carriage return" is eliminated by having two printing heads used alternately and so positioned and correlated that when one finishes printing a line, the other is ready to move into position to start the next line while the paper is being line spaced for the next line.

For this machine, either keyboard (of FIGURES 1 and 2) may be used, as preferred, the modifications for FIGURE 2 keyboard having been explained. The fixed commutator of FIGURE 4 and FIGURE 5, or FIGURE 7, of master characters is utilized along with the single revolution clutch mechanism of FIGURE 6. The electromagnetic clutch **37** (FIGURE 4) is used, in this machine, to drive the traveling belt with two print heads. During printing, this belt will be driven only as space signals are received, so that columns of characters *not* energized by selection keys will not cause gaps between letters of the same word—printing will be automatically closed up toward the left, as discussed for the previously described forms of this invention.

In FIGURE 12, **101** is a wide record sheet carried by the platen **102**, which has an electrically conductive surface behind the printing line to provide a common return circuit for the electrical print signals. One way of providing this electrically conductive surface would be to make the platen of electrically conductive rubber. The traveling belt **103—103** carries the two print heads **104** and **105**, which contact the record sheet on the platen side and at the same time carry contact brushes riding separate contact bars for conducting print signals, etc., as will be explained in detail. The travelling belt rides on and is supported by the two sprocket pulleys **106** and **107**, **106** preferably being the idler pulley and **107** being the driving pulley. The space between the pulleys and inside the loop of the belt is occupied by a static island-like structure, generally designated as **108**, which carries the contact bars on which the contact brushes of the print heads ride. As shown in FIGURE 15, which is a vertical cross section taken at the line B—B of FIGURE 12, looking in the direction of the arrows, the horizontally extending portions of **108** support the belt **103** along its entire length, thus providing uniform pressure of the print heads against the record sheet for good electrical contact for character printing.

FIGURE 14 includes a vertical cross section taken along the line A—A of FIGURE 12 looking in the direction of the arrows. In FIGURE 14, print head **104** is shown diagrammatically with 7 vertical contact elements (preferably individually spring loaded) contacting the record sheet **101** which is carried by the platen **102**. These 7 contact elements do the printing, as they transmit character signals singly and in various combinations to reproduce the master characters selected and energized by the operation of the keyboard, while the print head **104** travels horizontally toward the right in synchronism with the scanning brushes travelling horizontally across the energized master characters and energized space controls. The print head **104** also carries 9 brushes lower down on the other side, adjacent the island-like structure **108**. The top 7 brushes of these nine ride conductive bars **109** which are internally connected to the character slip ring brushes of the group **67** shown in FIGURE 5. The "space" slip ring brush **214** (FIGURE 5) of group **67** is connected to the electromagnetic clutch **37** (FIGURE 4). The output shaft of electromagnetic clutch **37** (FIGURE 4) for this wide paper machine is coupled to the sprocket belt driving pulley **107** of FIGURES 12 and 14.

Note that although there are 9 vertically arranged

brushes on the rear of the print head 104, there are only 7 contact bars 109 for them to contact on the side of 108 facing the platen. The top 7 of these 9 brushes are internally connected to the corresponding 7 conductive marking electrodes of the print head which print on the record sheet. The bottom 2 brushes, of the group of 9, are internally connected together and serve to close the circuit between the two contact bars 110 (see FIGURES 13, 14 and 15) for tabular horizontal spacing, and other controls, as will be explained later. The contact bars 110 extend as a continuous pair (see FIGURE 15) from a point indicated by the dotted line 111 (FIGURE 12) toward the left, and around the circular end of structure 108 and terminate opposite the dotted line position 112, where the bottom two brushes of the group of 9 will ride off the ends of the contact bars 110 and this circuit will be broken. The belt 103 will then come to a stop with one of the two print heads in position to start printing the next line.

In FIGURE 14, 113 generally designates a slip friction clutch which is adjusted so that it does not slip when action of the electromagnetic clutch 37 drives the belt 103, but this friction clutch can be overridden for back spacing or for manually positioning the print head 104 or 105 by turning the knob 114 (FIGURES 12 and 14).

It is a matter of design choice whether to use an electromagnetic clutch 37, which automatically brakes to a stop when de-energized and clutches when energized, or one which clutches when energized and stops but is not held braked when de-energized. Both types are available. In this wide sheet printer the type which brakes when de-energized is believed preferable, and then the slip clutch 113 is needed. However, where the braked type is not used, and there is sufficient friction in the system to provide good stopping without brake action, the slip clutch can be omitted if preferred.

Note that in this wide sheet printer, the visibility of the already typed text is excellent, each character becoming visible immediately after it is printed.

The backspace mechanism is shown in FIGURE 12, where 115 is the backspace key, pivoted at 116, and normally held up against the stop 117 by action of the tension spring 118. The ratchet rack member 119 is attached to key 115 by pivot 120A. The rack 119 has a slotted portion 120A which cooperates with a stud 121 to move the ratchet teeth of rack 119 into engagement with the ratchet gear 122, mounted on shaft 123 coupled to sprocket pulley 106 to drive the latter in a counter clockwise direction to backspace the belt 103 and the print heads 104 and 105. Release of back space key 115 enables tension spring 118 to return key 115 and rack 119 to their initial positions, with 119 out of engagement with ratchet gear 122.

In FIGURE 13 the "Line Space" key and associated mechanism are shown. Operation of the "Line Space" key in this machine automatically (1) spaces the paper vertically, and (2) automatically moves the waiting print head into position for starting the printing of the next line without delay, and (3) locks the character keys of the keyboard momentarily so printing cannot take place while the paper is being fed vertically. The methods and apparatus used are as follows:

In FIGURE 13, the record sheet 101 is carried by the platen 102, on one end of which is the ratchet gear 124 operatively engaged with the ratchet rack member 125 which is attached by pivot 126 to bell crank 127, pivoted at 128, and pulled by tension spring 129 to its normal position against stop 130. The spring 131 holds rack 125 in operating engagement. If the operator wants to turn the paper backwards, the horizontally bent over portion 132 of rack 125 can be pressed downwardly with one hand until rack 125 abuts against stop 133 which disengages rack 125 from ratchet gear 124, and the operator can turn the platen backwards with the other hand using either of the platen knobs 134—134.

The "Line Space" key is operated subsequently to the printing of the last word or letter group on a given line, and transmits current from plus power through the contacts 135 to electromagnet 136. Thereupon magnet 136 moves bell crank 127 in a clockwise direction about pivot 128 thereby moving ratchet rack 125 toward the right riding over the ratchet teeth of ratchet 124. The platen 102 is prevented from reverse rotation by the use of a roller detent (not shown) well known to the typewriter art, which can be easily over ridden by positive feeding actions or by manual turning of a platen knob. When the "Line Space" key is released, the tension spring 129 pulls the bell crank 127 in a counter clockwise direction about pivot 128 and against stop 130, which action moves ratchet rack 125 toward the left and rotates platen 102 to feed the record sheet 101 vertically for printing on the next line.

When the "Line Space" key is depressed, the following actions also occur to automatically position the waiting printing head for commencing the printing of the next line. Plus power passes through the lead 137 to one of the contact bars 110 (FIGURES 13, 14 and 15). The lower two brushes (internally connected) of the print head 105 (FIGURES 12 and 14) in position on the side away from the platen, in FIGURE 12, passes current to the lower contact bar of the pair 110 (FIGURE 13). This current passes through the contacts 138 energizing relay 139. The closing of the relay contacts 140 causes relay 139 to set up its own holding circuit, power coming through lead 141 from lead 142. This holding circuit will stay set up until the two lower contact brushes of the print head run off the end of the pair of contact bars 110, thus breaking the supply circuit to relay 139, stopping the belt in print position, and unlocking the keyboard. While relay 139 is energized it is also supplying plus current through lead 141 and the closed contacts 143. The lead 144 is connected to the electromagnetic clutch 37 (FIGURE 14) which causes the belt 103 to be driven as long as clutch 37 is energized. Lead 145 (FIGURE 13), connected to lead 144, supplies plus current to electromagnet 146, shown in FIGURE 16. This same electromagnet 146, and its associated mechanism, are used in both the 8½" by 11" wide sheet printer being described now, and also in the modification of this printer to handle wide fanfold paper, continuous forms, etc. The purpose is to lock up the keyboard momentarily while the sheet is being fed vertically so that printing can not occur during this paper feeding operation. When the electromagnet 146 is energized the bell crank member 147 is rotated clockwise about pivot 148. The vertical portion 149 of bell crank 147 extends transversely across the keyboard under the keys, as shown, parallel to the keybar comb 153 and normally being held out of the way of the key bars 152 by tension spring 150 and against stop 151. When magnet 146 is energized, however, the vertical portion 149 moves to the right intercepting and blocking operation of any of the character selector keybars 152.

In FIGURE 14, the "Tab Key" 197 may be operated for indenting for paragraphs, or for tabulating for printing columns of text, for filling out forms or for other similar work. A full set of individual tab stops, designated generally at 198, may be provided across the sheet width, one for each print position. In FIGURE 14, tab stop 199 is pulled back to an inoperative position, while tab stop 200 is pushed forward to an operative location, and is shown in cooperative relationship with the bottom portion of print head 105. The whole group of settable tab stops 198 are mounted on a common bail member 201, pivoted at 202 and normally pulled by tension spring 203 up against stop 204. In FIGURE 14, bail 201 is shown in the operated position, where a beveled face (not shown) on the lower portion of print head 105 (but shown on print head 104) has cammed settable stop 200 downwardly, thereby breaking the contacts 205. The circuit action is as follows:

In FIGURE 14, when the "Tab Key" **197** is operated, plus current flows through lead **206**, through the contacts **207**, into the plus side of relay **208**, out the minus side of relay **208**, along lead **209**, through the contacts **205** (which are normally closed) and then to the minus side of the power supply. When relay **208** is thus energized it sets up its own holding circuit, plus current flowing through lead **206**, along lead **210**, through the lower contacts of contact group **211**, into the plus side of relay **208** and out through its negative return circuit which has already been traced. This holding circuit stays energized until the next settable tab stop in operative position is cammed down by the moving print head on the side away from the platen, this situation being the one shown in FIGURE 14. As long as relay **208** is energized, plus current is flowing also to the electromagnetic clutch **37** which couples the motor drive **38** to the traveling belt **103** and print heads **104** and **105**. The electromagnetic clutch **37** is thus energized by plus current flowing through lead **206**, along lead **210**, across the lower contacts of **211**, up lead **212**, across the upper two contacts of contact group **211** and into the plus side of the electromagnetic clutch **37**, and out its minus side to the negative side of the power supply.

FIGURE 16 shows the modifications of the wide sheet printer (8½" by 11", legal sizes, etc.) to print on fanfold, paper, roll paper or continuous forms. The primary additional features are means to automatically sense when the bottom of a page length has been reached; and to automatically feed the paper vertically by an amount equal to the bottom margin of that page plus the top margin of the next page, automatically stopping the paper, for printing on the first line of the following page. The paper would be separated later along page predetermined separation lines to provide sheets of uniform length. The keyboard is to be automatically locked while the paper is being fed vertically. Also, pages will sometimes have text printed down along only part of their length, when it may be desirable to start the next text on a fresh page. Operation of a special key, the "Page Space" will automatically accomplish this, as will be explained.

In FIGURE 16, **154** is a typical record sheet having a registration mark **155** preprinted thereon in predetermined relation to the edge of the sheet and in relation to the page separation line **156**. Line **156** may be printed only, or perforated only, or both. If perforated only, care should be taken so that the light reflected is altered sufficiently so that the photoelectric sensing unit will respond reliably to stop the automatic paper feeding. Probably both printing and perforating separation line **156** would be the most practical, and this will be assumed for explanation purposes. The registration mark **155** will be assumed to be printed in black or colored ink. However, if preferred, this mark and/or the perforation line might be printed with an ultra violet absorbing agent to be used in conjunction with ultra violet light sources and filters in the photoelectric registration head. This could render the registration marks transparent and non-detectable to the human eye, thus improving the appearance of the record sheets in uses where this might be important. Any preferred one of the following materials might be used for such ultra violet absorption: homomethyl salicylate; ethoxethyl methoxycinnamate; p-amino benzoate; isobutyl salicyl cinnamate; glyceryl p-amino benzoate, or other suitable aromatic organic compounds.

157 is the photo electric (P.E.) head shown in both the end elevation view of the platen **102** at the right (FIGURE 16A) and in the plan view at the left. For the fanfold vertical paper feeding, the separate motor **158** is provided with gearing and shafting including driving gear **160** and driven gear **161** mounted on the platen. Care should be taken to either avoid any non-reversible worm gears or a friction clutch may be included in this drive train, because the operator will sometimes want to turn the platen backwards manually in positioning the paper vertically (as on a typewriter). The P.E. head **157** contains preferably one light source and two separate photosensitive pickups, one located to sense registration mark **155**, and the other located to sense the separation line **156**. The P.E. power source for the light source, and the separate amplifiers are shown diagrammatically as one box **163** in FIGURE 16. P.E. Unit No. 1 senses registration mark **155** and delivers power to the outgoing lead labeled No. **1**, from box **163**. P.E. Unit No. 2 senses page separation mark **156** and delivers power to the outgoing lead labeled No. **2** from box **163**.

When P.E. Unit No. 1 senses registration mark **155**, plus current flows through relay **164**, out lead **165**, along lead **166**, through contacts **167** of relay **168** to the return side of the power supply (marked "minus"). When relay **164** is energized it sets up its own holding circuit by having plus current flowing in through lead **169**, and through contacts **170** and then into the plus side of relay **164**. This holding circuit keeps relay **164** energized until the energizing of relay **168** separates contacts **167**, breaking the return circuit of relay **164**. The energizing of relay **164** does not, by itself, cause vertical paper feed; we need to be sure the operator does not want to print anything on that line. When the "Line Space" key **172** is operated after relay **164** is energized, plus current flows through lead **173**, through contacts **174**, through lead **175**, through contacts **176**, through lead **177**, through motor **158**, out through lead **166**, through contacts **167**, and to minus power.

When the "Line Space" key **172** is operated, *if* P.E. Unit No. 1 is also sensing registration mark **155** and relay **164** is energized, the relay **183** is energized and sets up its own holding circuit which stays up until sheet separation line **156** is sensed and relay **168** is energized. The relay **183** and its holding circuit are provided in case the operator were to let up the "Line Space" key **172** breaking contacts **174** before the vertical feeding of the record sheet is completed. The energizing of relay **183** is as follows: When "Line Space" key **172** is depressed, plus current flows along lead **173**, through contacts **174**, along lead **175** through contacts **176** (relay **164** having been previously energized) along lead **177**, along lead **184**, into the plus side of relay **183**, out its minus side, across contacts **167** (relay **168** not being energized yet) and to the minus side of the power supply. When contacts **184** close, plus current from lead **173** flows into the plus side of relay **183** through contacts **184** establishing the holding circuit in relay **183**.

The motor **158** continues to drive the record sheet vertically until P.E. Unit No. 2 senses the sheet separation line **156** and energizes relay **168** thereby breaking the return circuit of motor **158** and relays **164** and **183**.

When relay **168** is energized, it sets up its own holding circuit and holds it for a brief but tangible period of time (a second or two) to assure that the automatic paper feeding is stopped even though the coasting of the motor **158**, its associated gearing and shafting, and the platen may carry the sheet separation line **156** out from under where P.E. Unit No. 2 reacts to it. The operation for this is as follows: When relay **168** is energized by P.E. Unit No. 2, plus current also flows along lead **178**, through contacts **179**, along lead **180**, through contacts **181**, and through the relay **168** to the negative power circuit. However, plus current from lead **180** also flows through the time delay device **182** to minus power. This time delay device **182** may be a bimetallic element with a heating coil, as shown, adapted to open the contacts **181** after the intended brief time interval discussed above. Separating contacts **181** de-energizes relay **168** which in turn also cuts off the heating current for the bimetallic unit **182**.

At any time when the motor **158** is feeding the record sheet vertically, the electromagnet **146** also is energized through leads **184** and **215**, locking the character selection keys so no printing will accidentally be done on the

moving record sheet. The action of this character selection key automatic locking has already been explained in connection with the 8½" by 11" printer where it is used also.

If a printing line, somewhere between the first and last lines, completes all the text wanted on that page, and the next printing is to start on a new page, the operator can depress the control key "Page Space" **185**. This will cause the automatic feeding of the record sheet upwardly for the remainder of that page, plus its bottom margin, plus the top margin of the next page, and will automatically stop the sheet at its first line position, ready for printing. This is accomplished as follows:

Depressing the "Page Space" control key **185** closes contacts **186**, whereupon plus current flows along lead **187** into the plus side of relay **188** then out through the minus side, along lead **189**, along lead **165**, along lead **166**, through contacts **167** and to the minus side of the power supply. This action also supplies plus current to the motor **158**. In addition, when relay **188** is energized, it sets up its own holding circuit by closing contacts **190**. Then plus current flows along lead **169**, through contacts **190**, and into the plus side of relay **188**. The return circuit of this relay has already been traced. The relay **188** will continue energized and this will continue to supply current to motor **158** until P.E. Unit No. 2 senses sheet separation line **156** and relay **168** is energized which will break the return circuit of relay **188** and render it de-energized.

While previously throughout this patent the marking means discussed has been the passage of electricity through electrosensitive paper (facsimile paper), FIGURES 17A, B and C show some alternative methods and means. These drawings are diagrammatic, enlarged, and not necessarily to scale. 17A is an end elevation representing a group of seven marking elements **191**, operated singly or in any combination, moving downwardly to hit a pigment-carrying (or pigment producing) carrier **192**, such as an inked ribbon, a carbon paper ribbon, or a chemical carrying member, the blow of any of these 7 elements producing a corresponding mark on the record sheet **193**. The relative movement of the record sheet **193** is at right angles to the group of marking elements **191**. 17B shows a diagrammatic side elevation, not to scale, of a magnetically driven marking element. This might be one of 7 steel reeds, tuned to the same frequency as a pulsating D.C. or alternating current fed to their driving electromagnets, so that the reeds might be vibrating continuously with a base level value of current, and already in motion, when a marking signal might be a sudden increase of voltage and current of the same frequency and phase as the base level current, producing a sudden large increase of amplitude of vibration so that an exceedingly rapid series of blows would be delivered against the pigment carrier (reminding one of a woodpecker). Since it would be easy to use a frequency of several hundred blows per minute, this could be a very rapid marking device. Also the marking would be continuous across the record sheet, as long as the master character conductive area continued for that particular element, and this continuous and sustained marking is a unique feature in the printers of this invention. For example, for marking elements printing the horizontal bars of an E, the printing these marking elements produce must be continuous across the width of the latter.

In 17C, a diagrammatic side elevation is shown of a piezo-electric element **194** energized by pulsating or alternating voltages supplied to it by leads **195** and **196**. The piezo-electric element could be barium titanate, quartz crystal, rochelle salt crystal or other preferred type. I am told that piezo-electric elements are so very rapid in following applied signals that their action is substantially instantaneous.

It is to be understood that the various embodiments shown and described herein are to be regarded only as illustrations of the invention and that various other combinations of the methods, principles, elements, or their equivalents are within the scope and spirit of the invention.

Having thus described my invention I claim:

1. In text recording equipment, the combination including a keyboard constructed for simultaneous selection of characters for the recording of words with full normal spelling, keys in said keyboard providing more than one full alphabet of characters with only one finger being required to record any character of the alphabet, said keys being constructed to be operated by both hands simultaneously, each hand being capable of selecting a plurality of characters simultaneously, a set of master characters corresponding to said keys, each of said master characters being energizable by actuation of its corresponding key or keys on said keyboard, sequence means constructed to fix said master characters relative to each other in a predetermined left-to-right character position sequence, character connecting means constructed to operatively energize the master characters corresponding to actuated character keys, sequence scanning means capable of being actuated by any selected key and constructed to scan all of said master characters in the sequence predetermined by said sequence means, a record member upon which selected characters are recorded, character recording means controlled by said sequence scanning means and constructed to record said energized master characters in said predetermined sequence, and moving means constructed to move said record member relative to said character recording means only when said sequence scanning means has sensed an energized master character or the space key has been actuated whereby blank character spaces occur only between words and not between characters of the same word.

2. In text recording equipment, the combination including a keyboard constructed for simultaneous operation of keys for maximum recording speed and having a predetermined character position sequence, a set of master characters corresponding to said keys, an electrical power supply, character connecting means, said electrical power supply being controlled by said character connecting means and said character connecting means being constructed to electrically energize only those master characters corresponding to the simultaneously operated keys, master character reproducing means including an electrosensitive record member, a printing head having a width such that all characters selected by a simultaneous stroke of the hands can be printed without relative movement between said record member and said printing head and sequence scanning means constructed to scan all of the master characters while sensing only the simultaneously selected master characters in the predetermined character position sequence, said sequence scanning means being constructed to convey the electrical power from the energized master characters to said printing head for recording all the characters selected by one stroke on the keyboard onto said record member without said record member being moved relative to said printing head.

3. In text recording equipment as defined in claim 1, character recording means constructed and coordinated with suitable record means whereby these in combination provide noiseless recording operation.

4. In text recording equipment as defined in claim 1, the record member including magnetic material.

5. In text recording equipment as defined in claim 1, means for recording code indicia of the selected characters, said code indicia being capable of controlling other equipment.

6. In text recording equipment as defined in claim 1, character recording means constructed for recording on a record member having a capacity of more than one page.

7. In text recording equipment as defined in claim 1, communication means enabling recording at a distance, this distance being defined as sufficient so that separate housings are used for the keyboard and for the distant recording means.

8. In text recording equipment as defined in claim 1, means designed for producing a plurality of records simultaneously.

9. In text recording equipment as defined in claim 1, character recording means and vertical record feed means so constructed that one complete word is recorded on each line, whether such words are single stroke or multiple stroke words, and the recording is not on a plurality of lines where a plurality of strokes is required to record one word.

10. In text recording equipment as defined in claim 1, record moving means constructed to move the record laterally relative to the recording means only while said simultaneously actuated keys are being sensed as contrasted with unactuated keys to cause the selected characters to be recorded with blank spaces only between words and not between characters of the same word.

11. In text recording equipment as defined in claim 1, including a control key and means controlled thereby for use when the recorded text of a page ends at some point intermediate between the top and bottom of that page, and means whereby operation of said control key automatically causes the record sheet to be fed vertically the rest of that page plus a top margin for the next page, and further means for stopping said vertical feeding of said record for printing at the first line position of the following page.

12. In text recording equipment as defined in claim 11, including means for automatically positioning the printing mechanism for printing the first word of the first line on said following page.

13. In text recording equipment as defined in claim 1, said recording means constructed for recording any one of the characters of the keyboard in each character recording position across the full printing area of said record sheet without lateral movement of the recording means relative to the record member.

14. In text recording equipment as defined in claim 1, said keyboard and said character recording means being constructed so that the simultaneously actuated keys for recording numbers are capable of recording two or more numbers of ascending numerical value in one stroke, and are capable of recording two or more numbers of descending numerical value in the same stroke, and are capable of recording two or more numbers of the same numerical value in the same stroke, and are capable of recording a plurality of numbers of both ascending and descending numerical value in the same stroke.

15. In text recording equipment as defined in claim 1, including keyboard and recording means constructed to enable the recording of a dollar sign to the left of one or more numbers recorded in the same stroke.

16. In text recording equipment as defined in claim 1, including keyboard and recording means constructed to enable the selection of the decimal point, the comma, the

percent mark (%), or the cents mark (¢), to be printed to the right of one or more numerals to be selected and recorded in the same stroke.

17. In text recording equipment, the combination including a keyboard of keys arranged in columns providing more than one full alphabet adapted to be operated simultaneously for recording words with full normal spelling and with a recording capacity up to ten characters per stroke with each character to be recorded being selected by one finger only, a stationary commutator having columns composed of electrically energizable character segments and space segments corresponding to the columns of characters on the keyboard, circuitry adapted to energize only those of the energizable character segments which correspond to the keys operated in a given stroke, a rotatable brush assembly having brushes positioned to scan said energizable character segments, a plurality of reproducing contact means electrically connected to said brush means by means of slip rings carried by said rotatable brush assembly, electro-sensitive record material in contact with said reproducing contact means, and moving means adapted to provide relative motion between said reproducing contact means and said record material, said motion corresponding to the relative motion between the scanning contact means and the energized characters of the master set and adapted to reproduce those characters only and in the sequence predetermined by the arrangement of characters on the keyboard.

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2,919,171	12/1959	Epstein et al.	197—1 X
2,951,121	8/1960	Conrad	178—30 X
2,997,361	8/1961	Christopherson et al.	178—30 X
3,068,985	12/1962	Arthur	197—14
3,085,132	4/1963	Innes	178—30
3,112,693	12/1963	Williams	197—1 X

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