

[54] SELF-TIMING CODE KEYS

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[58] **Field of Search**.....340/365, 345, 349, 353

[56] **References Cited**

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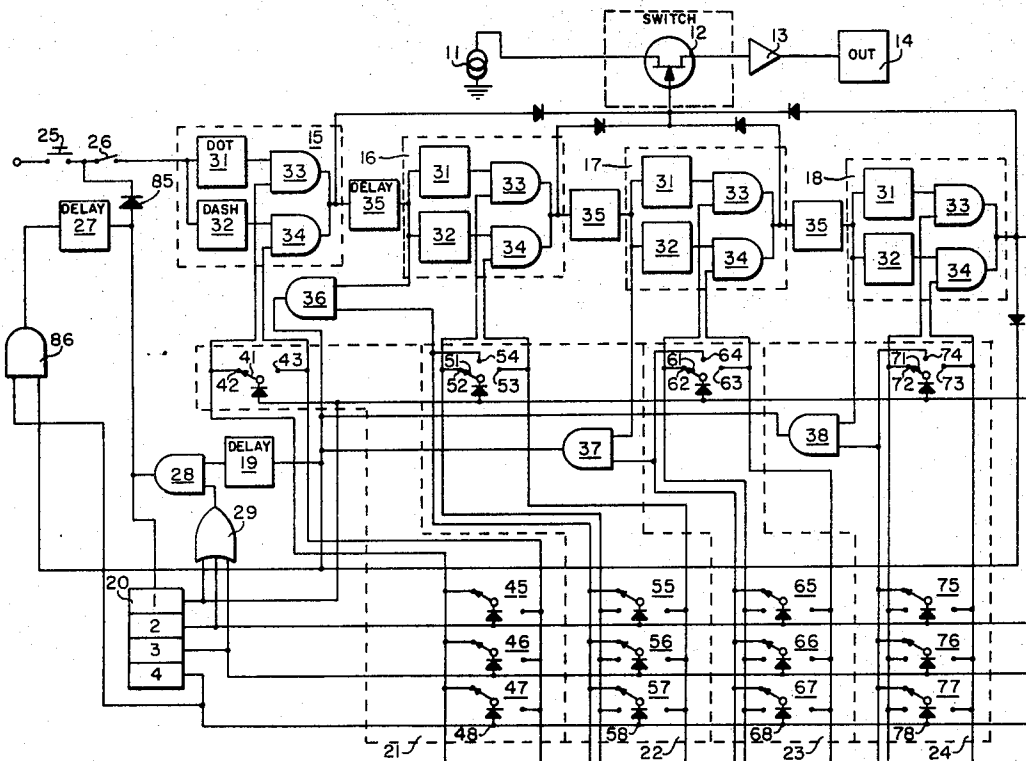
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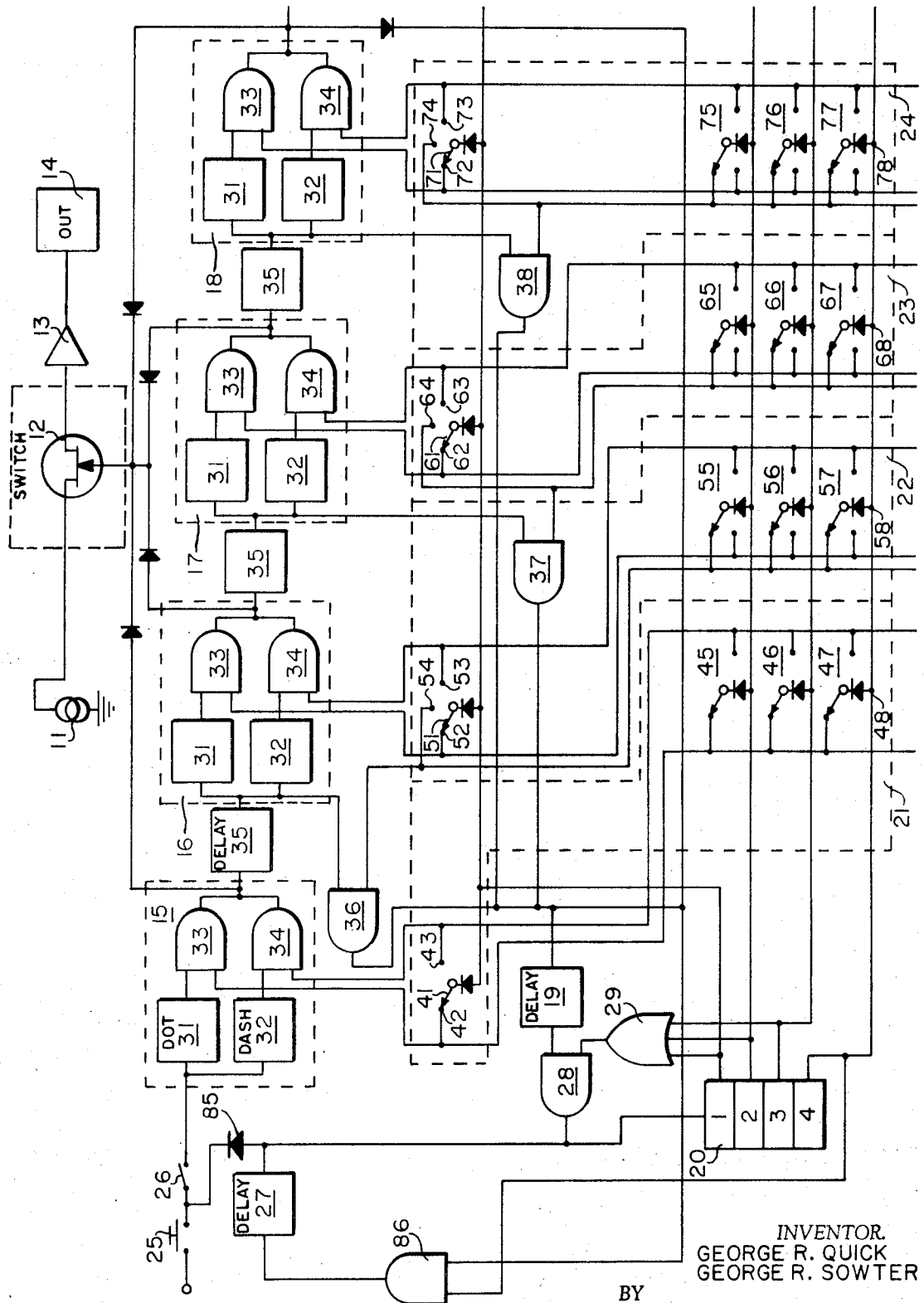
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[57] ABSTRACT

This is an automatic code keyer which can be used, for example, for automatically generating in Morse code the call letters of a radio transmitter. The keyer of this invention is simpler and has fewer parts than prior art devices. It comprises a plurality of selection circuits which activate individual dot or dash circuits. In each case where a dot is selected, a short pulse is generated, and if a dash is selected, a long pulse is generated. The generation of a pulse opens a gate which permits a tone to be transmitted to the output for a duration of the pulse. The selection devices are manually controlled and are operated to select the appropriate dot or dash for each element of a desired letter. If neither is selected, the pulse is applied to the next line of selection devices which control the original pulse generators and gating circuits. The system may be expanded to provide for the automatic generation of any number of letters.

8 Claims, 1 Drawing Figure





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SELF-TIMING CODE KEYS

This invention relates to an automatic keying device for generating information of a prescribed code.

Prior art keying devices have been either very complex for an automatic device, or very simple for a nonautomatic device. The simplest keyer is, of course, the standard telegraph key. The speed of generation of letters using a manual key and the ease with which those letters are recognized by another depends, to a great extent, upon the skill of the operator. This, obviously, is a drawback of nonautomatic keyers. In addition, radio navigation stations are normally situated where automatic operation is a necessity. For such installations, an automatic keyer is required. Prior art automatic keyers have been complex electromagnetic devices which require a substantial amount of maintenance in order to obtain reliable operation. Even the newer solid-state devices suffer from undue complexity with the attendant decrease in reliability and increase in initial and maintenance costs.

It is an object of this invention to provide a new and improved automatic code keyer.

It is another object of this invention to provide a new and improved simplified automatic code keyer.

It is a further object of this invention to provide a new and improved automatic code keyer which is expandable to any desirable size.

It is still another object of this invention to provide a new and improved automatic code keyer of simplified construction.

Other objects and advantages of this invention will become more apparent as the following description proceeds, which description should be considered together with the accompanying drawing which is a logical block diagram of the system of this invention.

Timing considerations are very important in the transmission of intelligence in systems such as Morse code. Considering Morse code as an example of the type of code that readily could be used in a system of this device, a dot is considered to occupy a single unit of time, a dash occupies three units of time, the spaces between dots and dashes occupy a single unit of time, spaces between letters occupy three units of time, and spaces between words occupy six units of time. It is important that these timing considerations be maintained regardless of how many dots or dashes (code elements) any letter may contain. Thus, if the first letter is an E, which is a single dot, the same three time units must be left before the next letter as would be the case if the letter were a Q (---). Referring to the drawing in detail, a switch 25 is shown having one side adjacent to a source of positive potential and the other side connected through a switch 26 to the inputs of one-shots 31 and 32. The output from the one-shot 31 is applied as one input to a gate 33, and the output of the one-shot 32 is applied as one input to a gate 34. The outputs from the two gates 33 and 34 are connected together and to the gate electrode of a field effect transistor 12 which operates as switch. The outputs from the gates 33 and 34 are also connected to the input of a delay 35. The other input to the gate 33 comes from a stationary contact 42 of switch 41 which has a second stationary contact 43 connected to the other input of the gate 34. The one-shots 31 and 32 and the gates 33 and 34 comprise the control device 15. The output from the delay 35 is simultaneously applied to the inputs of additional

one-shots 31 and 32, whose outputs respectively feed the inputs to additional gates 33 and 34. The outputs from the additional gates 33 and 34 are connected together and to the gate electrode FET 12 and to the input of a further delay 35. The additional one-shots 31 and 32, and the additional gates 33 and 34 constitute second control device 16. The additional control devices 17 and 18 are identical to control devices 15 and 16, and each comprises, one-shots 31 and 32, and gates 33 and 34, all of which are connected as in the control device 16. Additionally, switches 51, 61, and 71 are provided with one stationary contact 52, 62, or 72 connected to the other input to the respective gates 33 in the respective control devices 16, 17, and 18 and with another stationary contact 53, 63, or 73 connected to the other input to the respective gates 34. Since all of the control devices 16, 17, and 18 are identical, only that of device 16 will be described in detail. The output of the delay 35 is also connected as one input to a gate 36 whose output is applied to the input of the delay 19. Each of the switches 51, 61, and 71 has a third stationary contact 54, 64, and 74, and the third stationary contact 54 is connected as a second input to the gate 36. The output from the delay 19 is applied as one input to the gate 28 whose output is connected through a buffer diode 85 to the junction of the switch 25 and switch 26, and also to the input of the counter 20. In this case, the counter 20 is a four-position counter, and the outputs from the first three positions are connected as separate inputs to the OR gate 29 whose output serves as the second output to the gate 28. In addition, the first output from the counter 20 is connected to the moveable contacts of the switches 41, 51, 61, and 71, which serve as selectors for the first letter from the keyer of this invention. Each letter which is to be automatically produced in code form by the device of this invention has a separate set of selector switches. The switches for the second letter are designated 45, 55, 65, and 75; the switches for the third letter are designated 46, 56, 66, and 76; the switches for the fourth letter (the illustrated device being shown for generating only four letters) being designated 47, 57, 67, and 77. A buffer diode 48, 58, 68, and 78 is provided in the path of the moveable contact for each of these switches. The second output from the counter 20 is connected to the moveable contacts of all of the switches 45, 55, 65, and 75. The third output from the counter 20 is connected to the moveable contacts of all of the switches 46, 56, 66, and 76; and the fourth output from the counter 20 is connected to the moveable contacts of all of the switches 47, 57, 67, and 77.

When the switch 12, shown as the FET, is conductive, the output from the audio generator 11 is connected to the amplifier 13 and to output circuit 14. As indicated above, the output circuit may be a transmitter, a speaker, or any other suitable output device or a relay. The rest of the circuitry shown determines when the switch 12 is conductive and when it is non-conductive. When the manual momentary switch 25 is closed, a positive signal momentarily is applied to the inputs of the one-shots 31 and 32 of the control device 15. The one-shots 31 and 32 are identical except for the lengths of time they remain in their unstable conditions. The one-shot 31, and this is true for all of the one-shots 31, is designed to remain in its unstable con-

dition for a single unit of time and its output is designated a dot. On the other hand, the one-shots 32 are designated to remain in their unstable conditions for three units of time, and their outputs are designated dashes. Both one-shots 31 and 32 in the control device 15 are placed in their unstable conditions by the momentary actuation of the switch 25. Which of the one-shot outputs used is determined by the gates 33 and 34. The switch 41 has its moveable contact placed so that it completes one circuit with the stationary contact 42, and another circuit with the stationary contact 45. If the stationary contact 42 is selected, a conditioning signal is placed on one input to the gate 33, and when the one-shot 31 is put into its unstable state, the pulse generated thereby is passed through the open gate 33. Under these conditions, since gate 34 has no such conditioning signal applied to its input, it remains nonconductive. When a dash is desired, the moveable contact of the switch 41 is positioned to complete a circuit with the stationary contact 43 to place a conditioning signal on the input to the gate 34. This also removes the conditioning signal from the gate 33. Then, when the one-shots 31 and 32 are placed in their unstable conditions, its gate 34 becomes conductive to pass a dash. The conditioning signal which is applied to either of the gates 33 or 34 comes from the number one output of the counter 20 to the moveable contacts of all of the switches 41, 51, 61, and 71. When the counter 20 changes its condition from, say, count one to count two, then the energization is removed from the switches 41, 51, 61, and 71 and is applied to the switches 45, 55, 65, and 75. The effect of this will be indicated below.

When a letter is selected for automatic generation in Morse code by the keyer, the switches 41, 51, 61, and 71 are positioned to select the appropriate dot or dash in the combination which represents that letter. Consider, for example, the letter A which is represented in Morse code by .- and which will be the first letter to be generated by the keyer. To accomplish this, switch 41 is set at contact 42, switch 51 is set at contact 53, switch 61 is set at contact 64 (which is off), and switch 71 is set at contact 74 (which is also off). Assume that the second letter to be generated by the keyer is an S, which is represented in Morse code by ... and which is to follow the letter A immediately. To generate the letter S, switches 45, 55, and 65 are placed in their dot positions, and switch 75 is placed in its off position. The switch 25 is momentarily closed placing the one-shots 31 and 32 in the control device 15 into their unstable states. The output from the one-shot 31 passes through the gate 33, which receives its conditioning signal from the switch 41. The signal which passes through the gate 33 is applied simultaneously to the delay 35 and the FET 12, which becomes conductive to permit the tone generated by the generator 11 to pass to the amplifier 13 and the output circuit 14. At the same time, the dot passes through the delay 35, which is a one time unit delay, and is applied to both the one-shots 31 and 32 in the control device 16. In this case, it is the gate 34 which receives its conditioning signal from the switch 51, so a dash is applied through the FET 12 and to the delay 35 of the control device 17. Since the letter A has only two code elements in it, the switch 61 is in its off position and this applies a conditioning signal to a gate

37 and applies no conditioning signal to the two gates 33 and 34. Thus, when the one-shots 31 and 32 in the control device 17 are set to their unstable conditions, no signal passes through either of the gates 33 and 34. However, the pulse which emerges from the delay 35 and sets the one-shots 31 and 32 of the control device 17 is also applied to the other input of the gate 37. This applies a signal to the input of the delay 19. The delay 19 is a three time unit delay, and its output is applied to one input of the gate 28 which is conditioned by the signal received from the one output from the counter 20. The output of the gate 28 passes through the buffer diode 85 and becomes the second energizing signal to be applied to the first one-shots 31 and 32 in the control device 15. At the same time, the output from the gate 28 is applied to the counter 20 which counts it to change to a second count condition. This removes the energization from the switches 41, 51, 61, and 71, and applies it to switches have been set for the second letter, S. Note that the same group of control devices, 15, 16, 17, and 18 operate in accordance with the selections made in the settings of the second bank of switches. In this case, the switches 45, 55, and 65 were set to their dot positions and the switch 75 was set to its off position. In accordance with the description given above, when the output of the gate 28 passes through the diode 85, it again sets the one-shots 31 and 32 in the device 15, and the signal passes through the gate 33 to be applied both to the FET 12 and to the delay 35. This operation continues through the devices 15, 16, and 17. Since the switch 75 is in its off position, no conditioning signal is applied to the gates 33 and 34 of the control device 18, but, instead, the conditioning signal is applied to the gate 38, and the output from the delay 35 passes through the gate 38 to be applied to the input of the delay 19. In this manner, the cycle begins all over again for the third letter and the fourth letter. However, the fourth (or last) letter operation is slightly different. The generation of the fourth letter is the same as the generation of the previous three letters. But at the end of the generation of the fourth letter, the final signal is applied to the delay 27 which is a six time unit delay (via gate 86) and which reinitiates the entire cycle.

As mentioned above, the timing in the generation of code signals is important. Some signals such as the letter E exist for a total of one time unit, whereas other letters such as J, Q, and Y are as long as 10 time units. It is important that one letter follow another in a single word spaced apart by one three time units regardless of the time duration of the previous letter. The arrangement of the system of this invention automatically provides this facility, and the entire system utilizes very few parts. Although shown as rotary switches, the selection switches such as 41, 51, 61, and 71 may just as well be toggle switches which are plentiful and inexpensive. The basic logic elements such as the control devices 15, 16, 17, and 18 as well as the audio or tone equipment, such as the generator 11, gate 12, amplifier 13, and output circuit 14, are used in the generation of all of the letters. Thus, to expand this keyer to generate 5 or 6 or 22 letters, all that is required is four additional toggle switches for each letter and modification of the counter 20 to count to the number of letters desired. The system of this invention is readily expandable to codes which have more code elements merely by ad-

ding the appropriate pulse control circuits and switches. The pulse control circuits added are identical to 18 and the switches are identical to 71.

The above specification has described a new and improved automatic code keyer which is simple in its construction and operation, yet is automatic and preserves the timing which is essential to good information identification. The system of this invention is versatile, readily expandible to generate and number of letters in an information train and is easily reset to change the information being generated. It is realized that the above description may indicate to others skilled in this art additional ways in which the principles of this invention may be used without departing from its spirit, it is intended that this invention be limited solely by the scope of the appended claims.

We claim:

1. Apparatus for automatically generating a prescribed coded message in which the message comprises a plurality of characters and in which each character is formed of a combination of long and short duration pulses, said apparatus comprising a group of individual element generators each adapted to generate a long duration pulse and a short duration pulse upon input energization, means for connecting the output of one element generator to the input of the next adjacent element generator so that the output of one element generator energizes the next element generator to provide self-sequencing of said apparatus, controlling means including a plurality of settable means arranged in rows and columns, each column of settable means being connected to one of said element generators to determine when said element generator passes pulses of long duration and when it passes pulses of short duration, each row of said settable means representing a separate character, and means for automatically stepping the operation of said settable means from one row to another.

2. The apparatus defined in claim 1 further including a source of electrical signals, a utilization device, gating means connecting said source to said device, and means for applying the output of each element generator to said gating means so that said gating means opens to pass signals from said source to said device whenever an element generator generates an output pulse.

3. The apparatus defined in claim 1 further including delay means equal to a specified delay between pulses interposed between the output of one element generator and the input to the next element generator so that the activation of one element generator is delayed after the occurrence of an output from the previous element

generator.

4. The apparatus defined in claim 1 further including a first gate having an input connected to the output of said means for generating a long pulse, a second gate having an input connected to the output of said means for generating a short pulse and means for connecting the outputs of said first and second gates together to form the output of the element generator.

5. The apparatus defined in claim 4 wherein each of said settable means comprises a simple switch having a movable contact and three stationary contacts, means for connecting the movable contact of each switch to one output of said stepping means, means for connecting a first stationary contact to a second input of said first gate, and means for connecting a second stationary contact to a second input of said second gate so that the setting of said stepping means selects the switches which are energized and the setting of the movable contacts of the selected switches selects which of said first and second gates is opened.

6. The apparatus defined in claim 5 wherein said automatic stepping means comprises a counter having a stepping input and a plurality of count outputs, said means for connecting the movable contacts to outputs of said stepping means including means for connecting the movable contacts of all of the switches in each row of switches together and to one of the count outputs of said counter so that as said counter counts the apparatus is stepped from one character to another.

7. The apparatus defined in claim 6 further including means for stepping said counter, said counter stepping means comprising a third gate for each element generator, means for applying the output of said delay between element generators to one input of said third gate, means for connecting the third stationary contact of each switch in a column to the second input of said third gate, a character delay equal to a prescribed time period between characters, means for connecting the outputs from said third gates to the input of said character delay and the output of said character delay to the stepping input of said counter.

8. The apparatus defined in claim 7 further including a message delay having a delay time corresponding to a prescribed time period between messages, a single fourth gate, means for connecting the output of said fourth gate to the input of said message delay and the output of said message delay to the input to said first element generator, means for connecting one input of said fourth gate to the last count output of said counter, and means for connecting a second input of said fourth gate to the third contacts of all of said switches.

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