

[54] **STROKE COUNTER MECHANISM**

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[56]

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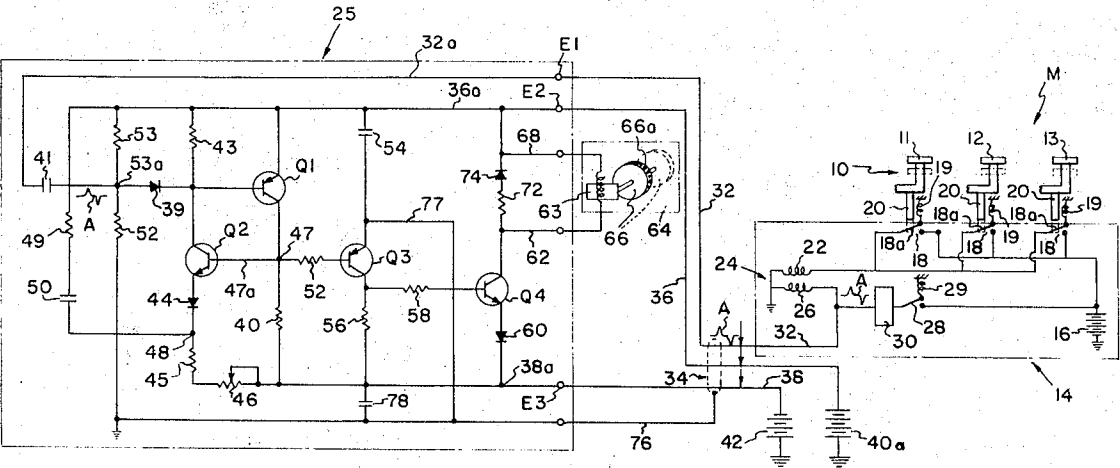
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ABSTRACT

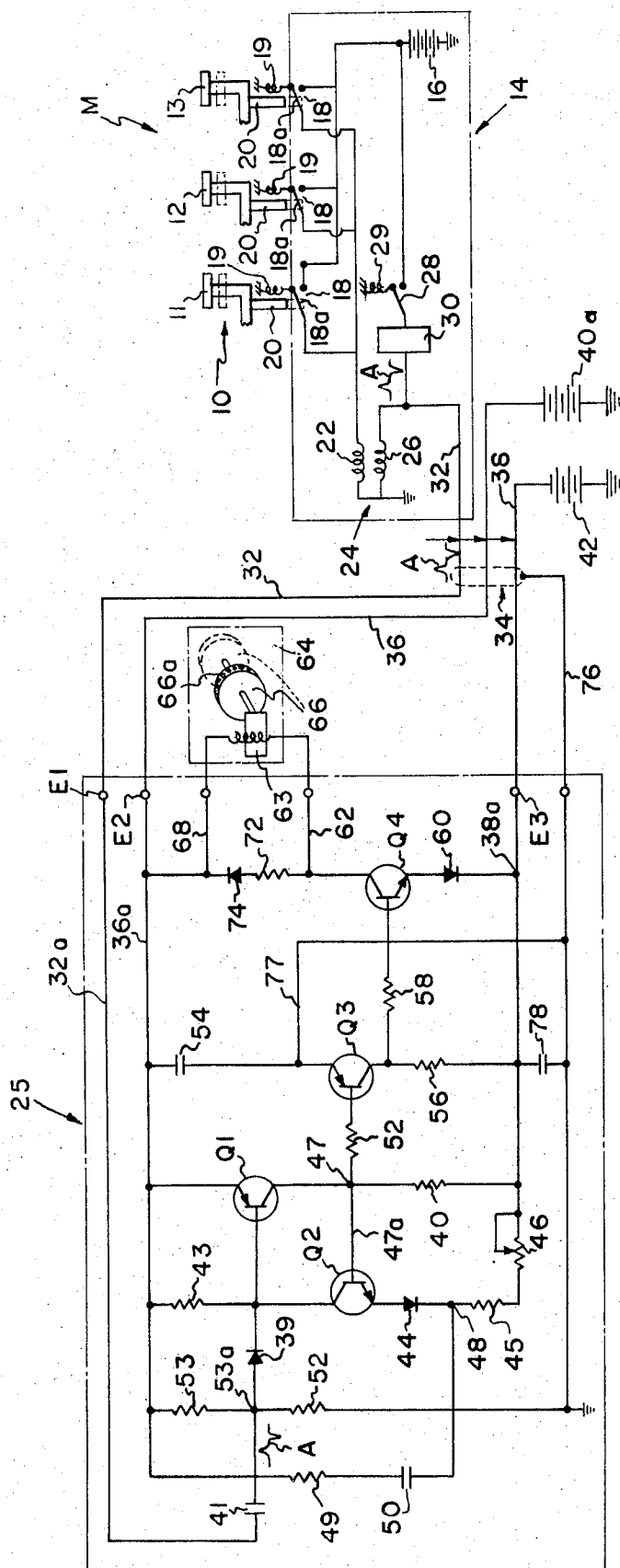
Stroke counting mechanism for counting the number of strokes which an operator makes in actuating the keys of a keyboard including apparatus for precluding a false count that otherwise would result when a key is stroked and held for a sustained period.

7 Claims, 1 Drawing Figure



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STROKE COUNTER MECHANISM

FIELD OF THE INVENTION

This invention relates to a stroke counter which is instrumental in determining the speed of a key punch operator, typist, or the like, and more particularly to counting apparatus which includes numbered counting wheels that are indexed in response to actuation of the keys of a keyboard to record accurately the number of times the keys are stroked. In a data processing center utilizing keypunch machines, for example, in data entry operations, one operator's workload may include a large number of data cards or tapes which involve duplicate or skipped entries that are quite simply and easily made by depressing a duplication or skip key on the machine's keyboard. Another operator's workload, however, may include little or no duplicate or skipped entries, but instead, may require a great many more strokes of the keyboard keys to complete the data entry. If the total number of data cards produced by these two operators is used to measure each operator's efficiency and production rate, then obviously the operator having to make greater number of keystrokes per card will have fewer cards. It is quite possible, however, that the operator producing the lesser number of cards will have performed a great many more keystrokes than the operator producing the greater number of cards. Simply counting the data cards produced by each operator at the end of a day, therefore, provides no reliable indication of the efficiency or performance of the operator. It is highly desirable, from the point of view of both management and operators, that a reliable system of evaluating the performance of each operator be established.

To a certain extent the problems in evaluating the performance of keypunch operators apply to operators of typewriting machines. Certain keys of the keyboard of the electrically operated typewriter have more than one operable position. For example, when the underscoring key of an electrically operated typewriter keyboard is actuated or depressed to a first position, the underscore typebar will strike the paper being typed with a single underscore mark and the carriage will index, or shift, one space. When, however, the underscore key is further depressed to a second position, the machine will automatically and sequentially shift the keyboard carriage a series of steps and simultaneously cause the underscore typebar to automatically strike the paper to provide continuous underscoring even though the key is stroked only once. Similarly, when the spacer bar or tabular key is depressed to a first position, the keyboard carriage will shift one or more spaces whereas when the spacer bar is depressed and held in a second position for a sustained period of time, the carriage automatically will shift without the operator's continuing to stroke the spacer bar.

In the use of key driven machines of the kind referred to above, it appears that counting the actual strokes performed by an operator on a machine's keyboard offers the most reliable means of evaluating the performance of a particular operator. Accordingly, the principal object of the present invention is to provide apparatus for counting such strokes.

Other objects and advantages of the present invention will be pointed out specifically or will become apparent from the following description.

SUMMARY OF THE INVENTION

Stroke counting apparatus for use with a keyboard having a plurality of systematically arranged keys each of which is movable between inoperative and operative positions to operate a machine such as a keypunch and comprising means for producing at least one electrical pulse signal each time one of the keys is stroked to its operative position, means connected to the pulse-producing means for counting the pulse signals and thereby the strokes, and count inhibiting means for preventing the counting means from counting successive pulse signals which are spaced from each other less than a predetermined time interval.

The present invention may be understood more readily by reference to the accompanying drawing, wherein the single FIGURE is a schematic diagram of a circuit embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Apparatus constructed according to the invention is particularly adapted for use with a key driven machine M having a keyboard generally designated 10 including a plurality of individually operable keys 11, 12 and 13 systematically arranged so that they may be manually stroked by an operator. The machine M may comprise a conventional electrically operated typewriter of a keypunch, also known as a card punch, for punching cards, paper tapes, or other data entry devices which customarily are used in entering data into a computer.

Associated with each of the keys 11, 12, and 13 is a typical pulse signal generating system, generally designated 14, which is operable to generate pulse signals when any of the keys 11, 12 and 13 are actuated or stroked. The system 14 includes a source 16 of electrical energy connected in series with a parallel circuit including a switch arm 18a of a switch 18 associated with each of the keys and positioned adjacent the associated keys 11, 12, and 13. Each of the keys 11, 12, and 13 is movable from a normal, inoperative position illustrated in solid lines to an operative position illustrated in chain lines to actuate a typebar or punch, shift the machine's carriage, or perform other similar operations normally performed in response to stroking of the keys of a keyboard. Each of the keys 11, 12, and 13 includes a depending finger 20 for moving its associated switch arm 18a to the closed position when any one of the keys 11, 12, or 13 is depressed to the operative position. The switch arms 18a normally are held in the inoperative, open position by springs 19.

The source 16 and the switches 18 are connected in series circuit relation with the primary winding 22 of a pulse transformer 24, the secondary winding 26 of which is operative to provide an output pulse signal A along the line 32 incorporated in a cable assembly generally designated 34, to an input terminal E1 of stroke counting apparatus, generally designated 25. The cable assembly 34 also includes conductors 36 and 38 connected respectively to positive and negative direct current batteries 40 and 42 to provide positive and negative biasing voltages at the terminals E2 and E3, respectively, of the stroke counting apparatus 25. The potential of the batteries 40 and 42 typically may be + 10 volts and -10 volts, respectively.

At least one of the keys, such as the key 11, is movable to a second operative position in which the finger 20 fixed thereto will engage and close a switch 28 connected in series with the battery 16 and a pulse train generating circuit, schematically illustrated at 30, which will generate a train of evenly spaced, identical pulse signals A. In this latter position, the key would be operative to automatically actuate the type or to punch a series of automatic strokes. A spring 29 is provided to bias the switch 28 to the open position. The pulse train generating system 30 conveniently may comprise a parallel circuit including a fast-charging capacitor and a voltage sensitive device, such as a neon bulb, connected in parallel therewith to short-circuit periodically the capacitor and permit the capacitor to discharge. The train of output signals A from the pulse generating system 30 are also supplied along the wire 32 to the terminal E1 of the stroke counting circuit 25.

The stroke or pulse counting apparatus 25 includes conductors 32a, 36a, and 38a connected to the terminals E1, E2, and E3, respectively, and an electrical valve such as the PNP transistor Q1, having its emitter connected to the positive voltage line 36a and its collector connected to a resistor 40 which is connected to the negative voltage line 38a. A noise filtering capacitor 41 and a diode 39 are connected in series in the line 32a which is connected to the base of the transistor Q1. The emitter-base junction of the transistor Q1 is normally forwardly biased by a biasing resistor 43 connected to the positive voltage line 36a and the base of the transistor Q1. A biasing resistor 53 is connected between the positive voltage line 36a and the junction 53a of the capacitor 41 and the diode 39. A biasing resistor 52 is connected between the junction 53a and ground potential.

The pulse counting circuit 25 also includes an electrical valve, such as NPN switching transistor Q2, having its collector connected to the base of the transistor Q1 and its emitter connected to the anode of a diode 44 which is connected in series with a fixed resistor 45, a potentiometer 46, and the negative potential terminal E3. The base of the transistor Q2 is connected to the junction 47 of the resistor 40 and the collector of the transistor Q1 by a conductor 47a. When the transistor Q1 is conductive, the junction 47 is at a sufficiently positive potential to bias the transistor Q2 into conduction, whereas when the transistor Q1 is non-conductive, the potential of the junction 47 is sufficiently negative to bias the transistor Q2 into non-conduction.

Connected between the junction 48 of the diode 44 and the resistor 45 and the positive potential line 36a is a series circuit including a resistor 49 and a charging capacitor 50. The charging current for the capacitor 50 is provided by the batteries 40a and 42. The potential drop across the capacitor 50 determines the potential at the junction 47 and the emitter of the transistor Q2. When the transistor Q2 is rendered non-conductive, the potentiometer 46 can be adjusted to control the potential across the capacitor 50 and the junction 47 to control length of time before the transistor Q2 again becomes conductive.

The pulse counting circuit also includes an electrical valve comprising a PNP transistor Q3 having its base connected to the junction 47 through a biasing resistor 52. The emitter of the transistor Q3 is connected to the

positive potential line 36a through a noise filtering capacitor 54 and the collector of the transistor Q3 is connected to the negative potential line 38a through a biasing resistor 56. A grounding conductor 77 is connected between the emitter of the transistor Q3 and ground potential. A noise filtering capacitor 78 is connected between the line 38a and ground potential.

An NPN transistor Q4 is incorporated in the pulse counting circuit 25 and includes an emitter connected to the negative potential terminal E3 through a diode 60 and a collector connected to the positive potential line 36a through a circuit including a line 62, the count coil 63 of a counter, generally designated 64, and a conductor 68. The counter 64 includes a bank of count wheels 66 which are sequentially indexed each time the count coil 63 is energized. The counter 64 may comprise a "Sodeco" unit manufactured by Landis & Gye, Incorporated, of Elmsford, N.Y., under Model No. TCeZ6E. The base of the transistor Q4 is coupled to the collector of the transistor Q3 through a biasing resistor 58.

A free-wheeling circuit comprising a resistor 72 and a diode 74 is connected in parallel with the count coil 63. Each count wheel 66 includes raised numbers 66a about the periphery thereof for providing a visual indication of the pulses counted. A ground line 76 is connected between the shield of the cable 34 and ground potential.

The following is a table listing the particular components which have been utilized in the circuit illustrated:

Capacitor	41	0.0039 microfarad, 100 volt
Resistor	49	470 ohms
Resistor	53	22 k. ohms
Resistor	52	22 k. ohms
Resistor	43	22 k. ohms
Capacitor	50	2.2 Microfarad, 20 volt
Transistor	Q1	2N52 26
Transistor	Q2	2N52 25
Resistor	45	3 k. ohms
Resistor	46	10 k. ohms
Resistor	43	2 k. ohms
Resistor	52	2 k. ohms
Transistor	Q3	2N5 226
Resistor	56	1 k. ohm
Resistor	58	470 ohm
Capacitor	54	10 microfarad, 15 volts
Transistor	Q4	2N3053
Counting Unit	64	SODECO TCeZ6E
Resistor	72	100 ohms
Capacitor	78	10 microfarad, 15 volts
Batteries	40 and 42	10 volts

THE OPERATION

When the keys 11, 12, and 13 are in their inoperative positions, illustrated in solid lines in the drawing, the biasing potentials at terminals E2 and E3 are such as to forward bias the transistor Q1 into conduction. When the transistor Q1 is rendered conductive, the potential at the junction 47 is sufficiently positive to bias the transistor Q2 into conduction. In the example chosen, when the transistor Q2 is conductive, the potential at the lower plate of capacitor 50 and the junction 48 will be approximately -3 volts, whereas the upper plate, as viewed in the drawing, of capacitor 50 will be charged to a potential of substantially +10 volts through the resistor 49. When the transistor Q1 is conductive, the potential at the junction 47 will maintain the transistor Q3 biased into non-conduction and when the transistor Q3 is non-conductive, the transistor Q4 also is biased into non-conduction.

When one of the keys 11, 12, and 13 is stroked or depressed so as to move one of the switches 18 to the closed position, a voltage pulse signal A will be coupled from the pulse transformer 24 to the base of the transistor Q1 by the lines 32 and 32a, the capacitor 41, and the diode 39. The potential of the pulse signal A is sufficiently positive to reverse bias the emitter-base junction of the transistor Q1 and render it non-conductive. The potential at the junction 47 abruptly changes from a positive value to a negative value to bias the transistor Q2 into non-conduction. When the transistor Q1 is rendered non-conductive, the transistor Q3 is biased into conduction and a positive signal is impressed across the resistor 58 to bias the transistor Q4 into conduction. Current then flows along a path from the terminal E2, through the count coil 63, the emitter-collector path of the transistor Q4, to the terminal E3. When current flows through the count coil 63, the count wheels 66 are indexed one increment to indicate a pulse count of one. Thus, each time one of the keys 11, 12, or 13 is depressed to close its associated switch 18, the wheel 66 will be indexed one increment to record or count the number of strokes made.

If the key 11 is stroked to the second operative position to close the switch 28, a train of pulses A will be impressed across the capacitor 41 and the base of the transistor Q1. If each pulse in this train of pulses were permitted to render the transistor Q1 conductive to index the count wheel 66, an inaccurate stroke count would result. To preclude this, the transistor Q2 is provided to determine the time the transistor Q1 is held non-conductive to inhibit multiple counts being recorded if the key 11 is depressed for a sustained period. After the initial pulse in a train of pulses renders the transistors Q1 and Q2 non-conductive, the junction 48 becomes increasingly negative and the lower plate of the capacitor 50 begins to charge more negatively through the resistors 45 and 46. In the example chosen, the potential at the base of the transistor Q2, when the transistor Q1 is non-conductive, is approximately -5 volts. The time in which the junction 47 and the lower plate of the capacitor 50 charges to a potential more negative than the -5 volts potential so as to render the transistor Q2 conductive, is variable by adjustment of the potentiometer 46. The potentiometer 46 should be so adjusted that the time interval between successive, automatic strokes of a type or punch, and thus the time interval between successive pulses in the pulse train, in less than that required for the transistor Q1 to become conductive but that the time interval required for the transistor Q1 to become conductive should be less than that between successive manual strokes of the keys. When the potential of the emitter becomes sufficiently negative relative to the potential of the base of transistor Q1, the transistor Q1 will again conduct allowing Q2 to be rendered conductive.

The disclosed embodiment is representative of a presently preferred form of the invention, but is intended to be illustrative rather than definitive thereof. The invention is defined in the claims.

I claim:

1. Stroke counting apparatus for a keyboard having a plurality of systematically arranged keys which may be individually manually stroked to operate a machine, said counting apparatus comprising:
means for producing an electrical pulse signal each time one of said keys is stroked;

electrically energizable and deenergizable counting means connected in circuit with said pulse producing means for registering a pulse signal, and thereby a stroke, each time it is energized;

first electrical valve means connectible to a source of electrical power operable in current conducting and non-conducting states and connected in circuit with said counting means for energizing, in said conducting state, said counting means;

second electrical valve means coupled to said pulse producing means and said first electrical valve means and operable in current conducting and non-conducting states for rendering, in said non-conducting state, said first valve means conductive in response to a pulse signal, and for rendering said first valve means non-conductive when said second valve means is in said conducting state; and count inhibiting means for precluding said counting means from registering successive pulse signals which are spaced from each other less than a predetermined time interval including means coupled to said second valve means for maintaining said second valve means in said non-conducting state for a predetermined time to preclude said first valve means from changing its conducting state, said means for maintaining said second valve means in said non-conducting state comprising third valve means which is rendered non-conductive when said second valve means is non-conducting and precludes said second valve means from conducting when said third valve means is non-conductive, and means responsive to said third valve means being rendered non-conductive for maintaining said third valve means in said non-conducting state for a predetermined time.

2. The apparatus set forth in claim 1 wherein said first valve means comprises

a first transistor having an input circuit, and an output circuit coupled to said counting means;

a second transistor having an input circuit, and an output circuit coupled to a source of electrical power and the input circuit of said first transistor; said second valve means comprises

a third transistor having an input circuit coupled to said pulse producing means and an output circuit coupled to said source and the input circuit of said second transistor

said third valve means comprises

a fourth transistor having an input circuit coupled to the output circuit of said third transistor and an output circuit coupled to said source,

means is connected to said first, second, and third transistors for biasing said first and second transistors to conducting and non-conducting states when said third transistor is in said non-conducting and conducting states, respectively, and for biasing said fourth transistor into a non-conducting state when said third transistor is in said non-conducting state;

said count inhibiting means including a capacitor charging circuit connected to said source and the output circuit of said fourth transistor for maintaining said fourth transistor non-conductive for a predetermined time to maintain said third transistor non-conductive.

3. The apparatus set forth in claim 2 wherein said count-inhibiting means includes variable resistance means coupled to the output circuit of said fourth transistor for varying the time said fourth transistor remains non-conductive.

4. The apparatus set forth in claim 3 wherein said counting means includes wheel means having count indicating indicia thereon; and a count coil connected in the output circuit of said first transistor for indexing said wheel means when said first transistor is in its conducting state.

5. In combination

a machine comprising

operative elements movable between inoperative and operative positions,

a keyboard having a plurality of keys individually movable between inoperative and operative positions, at least one of said keys being movable to an additional operative position for causing a series of operations to be performed by at least one of said elements,

means coupling said keys and said operative elements for causing said elements to move from said inoperative to said operative positions when the keys are stroked including

means for producing electrical pulses which are spaced from each other not less than a predetermined time interval and means for producing at least one electrical pulse signal each time one of said keys is moved to its operative position, and

means for producing a train of electrical pulse signals which are spaced from each other less than said predetermined time interval each time said one key is stroked to said additional operative position,

stroke counting apparatus for counting the keys

stroked to said operative position for said additional operative position comprising:

electrically energizable and deenergizable counting means connected in circuit with said pulse producing means and a source of electrical power for registering a pulse signal, and thereby a stroke, each time it is energized,

normally non-conductive valve means coupled to said counting means;

means for rendering said valve means conductive in response to a pulse signal to energize said counting means and for rendering said valve means non-conductive in less time than said predetermined time interval; and

count inhibiting means for maintaining said valve means in said conductive condition for a time interval greater than said lesser predetermined time interval but less than said predetermined time interval.

6. The combination of claim 5 wherein said counting means includes indexible wheel means having count indicating indicia thereon; and a count coil connected in circuit with said valve means for indexing said wheel means when said valve means is conductive.

7. The combination set forth in claim 6 wherein said means for rendering said valve means conductive and non-conductive comprises a first normally conductive valve coupled to said valve means and being rendered non-conductive in response to a pulse signal to render said valve means conductive, and a normally conductive second valve coupled to said first valve and being rendered non-conductive when said first valve is rendered non-conductive; and means for maintaining said second valve non-conductive for a time greater than said lesser predetermined time and lesser than said predetermined time.

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