

May 3, 1966

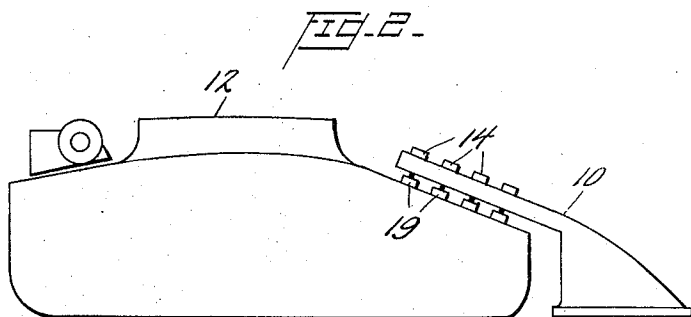
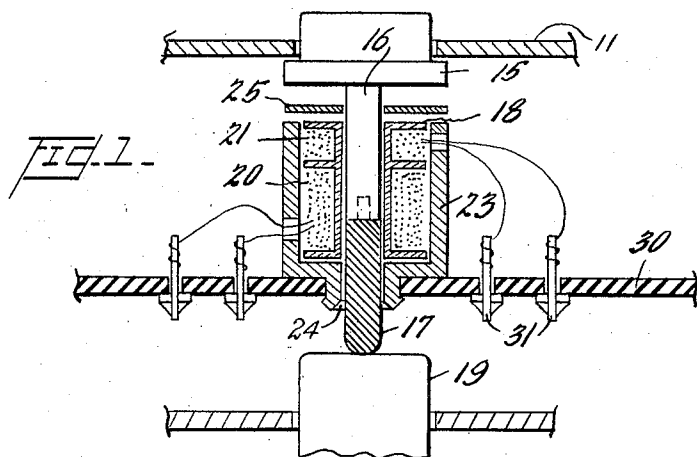
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3,249,199

ELECTRONIC KEYBOARD CONTROL SYSTEM

Filed May 22, 1963

3 Sheets-Sheet 1



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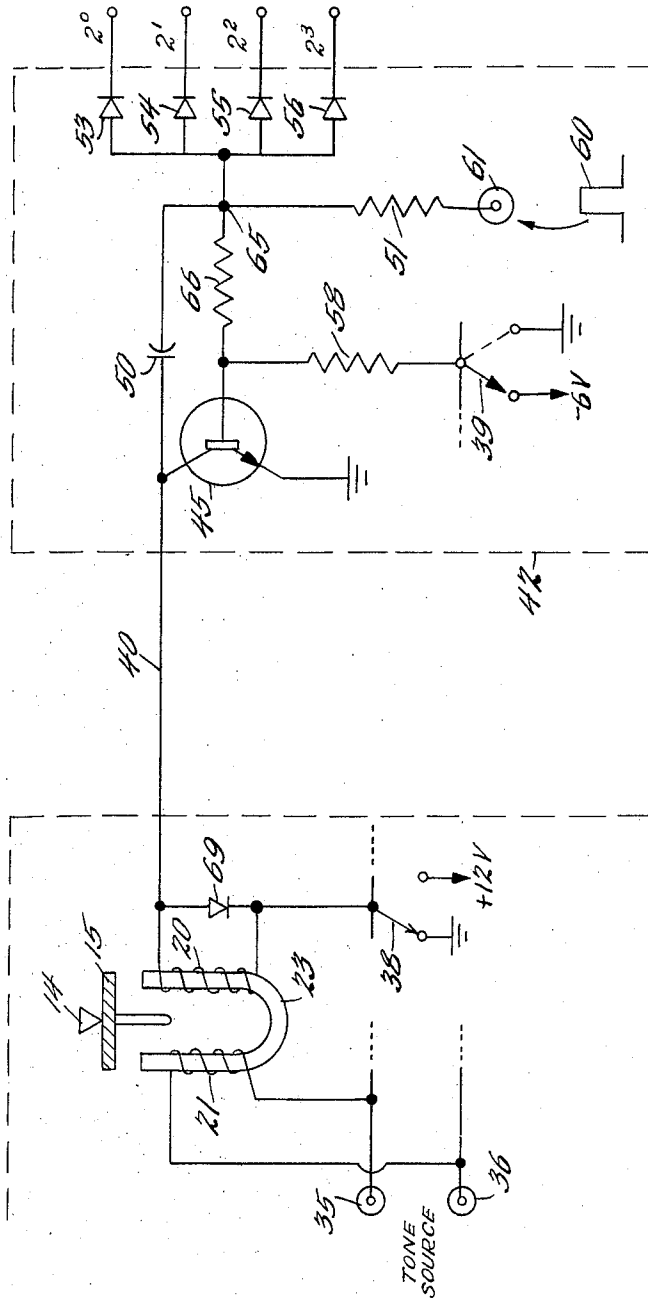
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3 Sheets-Sheet 2

FIG. 3-



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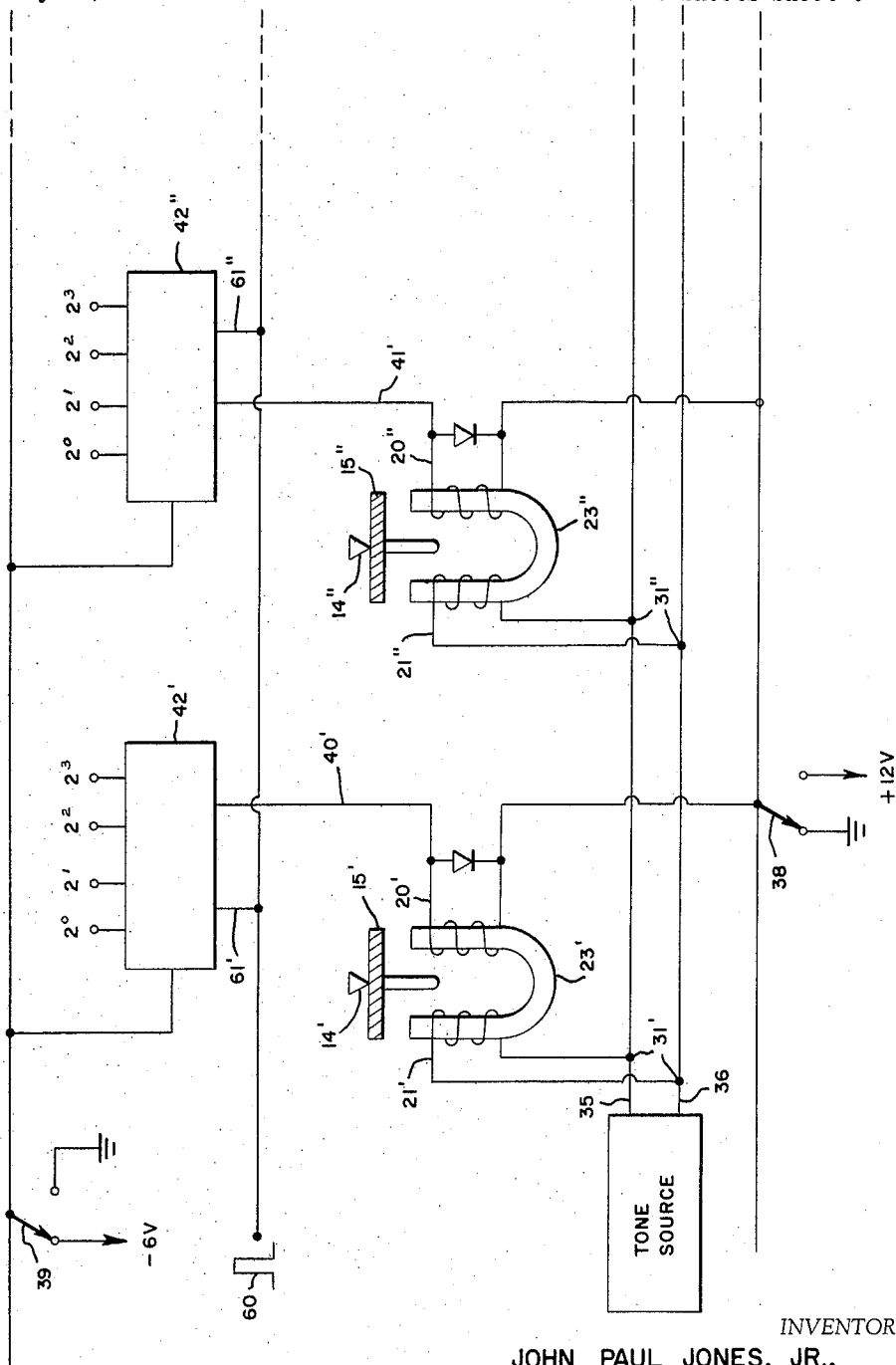
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FIG. 4



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ELECTRONIC KEYBOARD CONTROL SYSTEM
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This invention relates to electronic control circuits and more specifically it relates to automatic control of keyboard operated equipment.

In the present stage of electronic computer development a bottleneck occurs in the input output capacities of a computer. At times in high speed electronic computers costing hundreds of dollars an hour to operate it becomes necessary to slow the computer down to the speed of input devices or printers. Such computers require significant amounts of input data from many manual sources to satisfy their capacity for data. Most of this is reprepared from original typewritten data sheets. Thus a means to obtain data as a byproduct from a standard typewriter is highly desirable.

Specialized typewriters for preparation of data are extremely expensive, and modifications of standard typewriters are not generally feasible since guarantees and service policies are not available from the manufacturer when machines are modified.

In addition when a typewriter fails, expensive non-standard equipment must be on hand during the service period. Also many specialized automatic typewriters do not give a variety of fonts and letter changes available on standard machines.

It is evident therefore that it would be desirable to provide a practical adapter unit for causing a standard typewriter to print and for providing signals as a byproduct of manual typing of letters or data. Such an adapter unit should be such that it does not interfere with typing or the touch of the secretary. Also it should be efficient and inexpensive and of such size that it is adaptable to good styling. It must be reliable in operation and should not depend upon switch closures which have been proven unreliable in continuous everyday use over long periods of time, and introduce bounce into electronic control circuits.

Accordingly it is an object of the invention to provide a simple reliable automatic control device for operating standard typewriters.

It is another object of the invention to provide a switchless control adapter unit for typewriters.

A further object of the invention is to provide an automatic control adapter which will either cause a typewriter to print responsive to electrical signals or will produce signals as a byproduct of typing which may be used in electronic equipment.

Another object of the invention is to provide automatic electronic typing controls without modifying a typewriter in any way.

Therefore in accordance with the invention, a keyboard adapter panel is provided which does not require mechanical modification of a typewriter in any way, nor does it alter the touch or feel of a typewriter in operation. This is accomplished by a key extension unit purely electromagnetic in operation so that manual power and switch closures become unnecessary. The key extension unit serves as a solenoid which operates the key for printing and alternately serves as an output device for readout of key depressions.

Further features and objectives of the invention will be explained with particularity in the following detailed specification with reference to the accompanying drawing wherein:

FIGURE 1 is a detailed sketch, partly in section of a key adapter afforded in accordance with the invention,

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FIGURE 2 is a diagram of a typewriter adapter unit as afforded by the invention in place upon a standard typewriter,

FIGURE 3 is a schematic circuit diagram of a control circuit afforded by the invention, and

FIGURE 4 is a diagram showing a plurality of interconnected keys.

FIGURE 1 illustrates details of the key adapter used in the overlay keyboard adapter panel 10 operating the keyboard of a standard electric typewriter 12 of FIGURE 2. The keyboard adapter panel is basically a flat metal box, approximately one inch high, which has a complement of auxiliary adapter key assemblies as shown in FIGURE 1. These keys are identical in spacing and shape and line up directly with the keyboard on the typewriter 12. The framework of the adapter keyboard assembly 10 confines the stroke of adapter key 14 to the normal stroke length of the typewriter key 19 as cap 15 engages panel 11 in upward position.

The adapter key 14 has an extension comprising magnetic solenoid cap 15, magnetic solenoid slug 16 and the non-magnetic push rod tip 17 comprising a movable cap-rod assembly. The adapter keys slide freely through the central hollow core of solenoid shell 18 to rest atop the typewriter keys 19 by force of gravity without springs or friction force impeding manual operation. Thus it is readily seen that no change in feel, stroke or touch is introduced through the adapter keyboard.

The solenoid coil has two sections 20 and 21. The larger actuating section 20 is used to close the key by pulling the solenoid slug 16 down when current is passed selectively through it by external command signals derived from the control boxes 42 of FIGURE 3. Tone signals are introduced into the adapter key and are read out through action of the smaller auxiliary winding section 21 by increasing magnetic coupling of the windings when the adapter key 14 is depressed closing the magnetic circuit of the solenoid through the solenoid cap 15, solenoid slug 16 and external solenoid cup core 23 having a central access aperture 24 registered with the hollow core of shell 18 to receive the cap-rod assembly portions 17. To keep operation substantially noiseless the felt washer 25 is introduced between the solenoid cap 15 and the solenoid cup 23. Note that use of the non-magnetic push rod tip 17 serves to permit efficient solenoid closure action of the typewriter key 19.

Normal operation of the typewriter when neither transmitting or receiving signals is not interrupted in any way by the adapter unit. The entire adapter keyboard assembly is mounted on a printed circuit board 30. The solenoid cup shells 23 are approximately 3/4 of an inch in diameter and mounted on 3/4 inch centers and can be placed in alignment with typewriter keys. Circuit terminal connectors 31 are provided for inter-key conductors, tone busses and input-output lines for which the adapter panel 10 provides sufficient space without interference with key action.

When the typewriter is receiving print signals to the solenoid winding 20, the closing action may be fashioned as fast as the maximum speed of an electric typewriter, and the operation of push rod 17 on the typewriter key 19 is controlled by electrical pulses which have that duration desired for optimum key closure of the typewriter model in use.

In transmitting key closure information, the circuit of FIGURE 3 shows the tone signal terminals 35-36 coupled by common busses to the tone windings 21 of all keys. A three kilocycle tone may be used, for example. When the air gap is open with adapter key 14 in uppermost position, the tone winding 21 is loosely coupled to winding 20. However, when the adapter key 14 is depressed and the air gap is closed, the coupling is increased

by a ratio of better than three to one and the tone coupled to output lead 40 is intensified. Thus with switches 38 and 39 in transmit position as shown, the output tone on lead 40 reaches the remote output amplifier control box 42 which operates as a tone detector in this mode with the tone signal by-passing the cut-off silicon controlled rectifier 45 passing through capacitor 50 to the output diodes 53-56. Thus, a clear tone modulated output signal is produced without switch closure, metal to metal contact, sound or wear.

Each typewriter key has a circuit similar to that of FIGURE 3. Thus the switches 38 and 39 serve to switch voltages in all solenoids on the adapter keyboard unit 10 and all amplifiers in the control boxes 42 simultaneously to either transmit position, in which they are shown, or receive position. As indicated by the dotted extensions on the leads in the drawing therefore a plurality of N stages is tied together in parallel by common busses. Such connections are shown in FIGURE 4.

In the transmit or readout mode of operation the tone signal is also switched to appear at terminals 35 and 36. With switch arm 38 grounded, windings 20 serve as secondary windings for coupling the tone signals to lead 40. Switch arm 39 cuts off the silicon controlled rectifier 45 so that it is not part of the circuit. Capacitor 50 and resistor 51 with diodes 53-56 serve as the output circuit means to encode or fan out the tone signals by presentation to the various busses connected to code terminals 20, 21, 22, and 23 to identify the key by a binary code. In the case shown four lines are energized by a modulated tone pulse when the key 14 is depressed. Thus the diodes serve as a mixer commonly called an OR gate during transmit mode while only requiring a single line 40 between the push button 14 at the keyboard and the control logic in the circuitry box 42.

In the typewriter printing mode of operation, +12 volts is coupled to winding 20 so that silicon control rectifier 45 can energize the solenoid and close the key 14. Silicon control rectifier is put into circuit by grounding the base through resistor 58 via switch arm 39. The plus 12 volt pulse 60 appearing at terminal 61 strobes the input diode gates 53-56, when the input busses are all in the positive potential AND gate position permitting resistor 51 to go positive designating coded selection of this particular key circuit. If all input diodes 53-56 are held at plus 12 volts, point 65 need only go slightly positive to drive silicon controlled rectifier 45 into conduction through series input resistor 66 and thus draw solenoid cap 15 closed by current through winding. The input pulse 60 has a duration of the proper length for actuating the typewriter keys.

After the strobe pulse ends, the amplifier goes into non-conduction by action of capacitor 50 and resistor 51. Diode 69 serves to damp the overshoot voltage in coil 20. All the AND gate diodes must be held closed for the duration of the strobe pulse period if the strobe pulse period is used to determine the length of key-down duration on the typewriter.

It is evident from the foregoing description that a simple yet reliable typewriter control unit is afforded by the invention with many advantages as set forth with particularity in the following claims.

I claim:

1. An electronic typewriter control system comprising, in combination, an adapter keyboard assembly adapted to fit over a keyboard of a conventional manually operated

typewriter, a plurality of adapter keys in said keyboard positioned to register with corresponding keys of the typewriter, each adapter key comprising a solenoid winding having a central hollow core, an external cup core with a central access aperture registered with the hollow core of said winding, a movable cap-rod assembly fitting into the hollow core to provide substantially a complete closed magnetic path with said cup core through the central hollow core of the winding in a closed position, with a non-magnetic extension rod affixed to said cap-rod assembly and positioned to engage one of the typewriter keys in gravity contact to keep the magnetic path in a normally open condition, a framework in said keyboard assembly confining motion of the cap-rod assembly to the normal stroke length of the typewriter key, each adapter key resting on the cap of the cap-rod assembly to serve as an auxiliary manually operated typewriter key, and terminal connectors on said winding for energizing it and pulling down said cap-rod assembly to thereby close the magnetic path and depress the key by electrical actuation thereby supplementing the manual mode of operation, wherein an auxiliary winding is provided inductively coupled to the first said winding, a tone source is coupled to the auxiliary winding, and a tone detector is coupled to the solenoid winding to distinguish between the tone level existing when the adapter key is manually depressed thus closing the magnetic path and improving the coupling coefficient between the two coils and when the magnetic path is open, whereby remote electronic equipment may be controlled from signals generated responsive to manual operation of the auxiliary typewriter keyboard.

2. A system as defined in claim 1 wherein a single conductor couples the tone detector to its corresponding other winding.

3. A switchless keyboard adapter for automatic control of a typewriter comprising in combination, a set of manually depressible keyboard extension keys each providing two operative positions respective to a magnetic core material producing open and closed magnetic circuits, at least two electrical coils disposed on the core material to thereby change their mutual coupling responsive to the two operative positions, and means coupled to the two respective windings of a key respectively to produce a tone signal in one winding and to detect only the intensified tone signal magnetically coupled through the circuit to the other winding when the magnetic circuit is closed to thereby signify the manual depression of the key.

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