Aug. 1, 1961 E. HOPNER ET AL 2,994,736

KEYBOARD ACCESS CONTROL SYSTEM

Filed Dec. 23, 1957 2 Sheets-Sheet 1

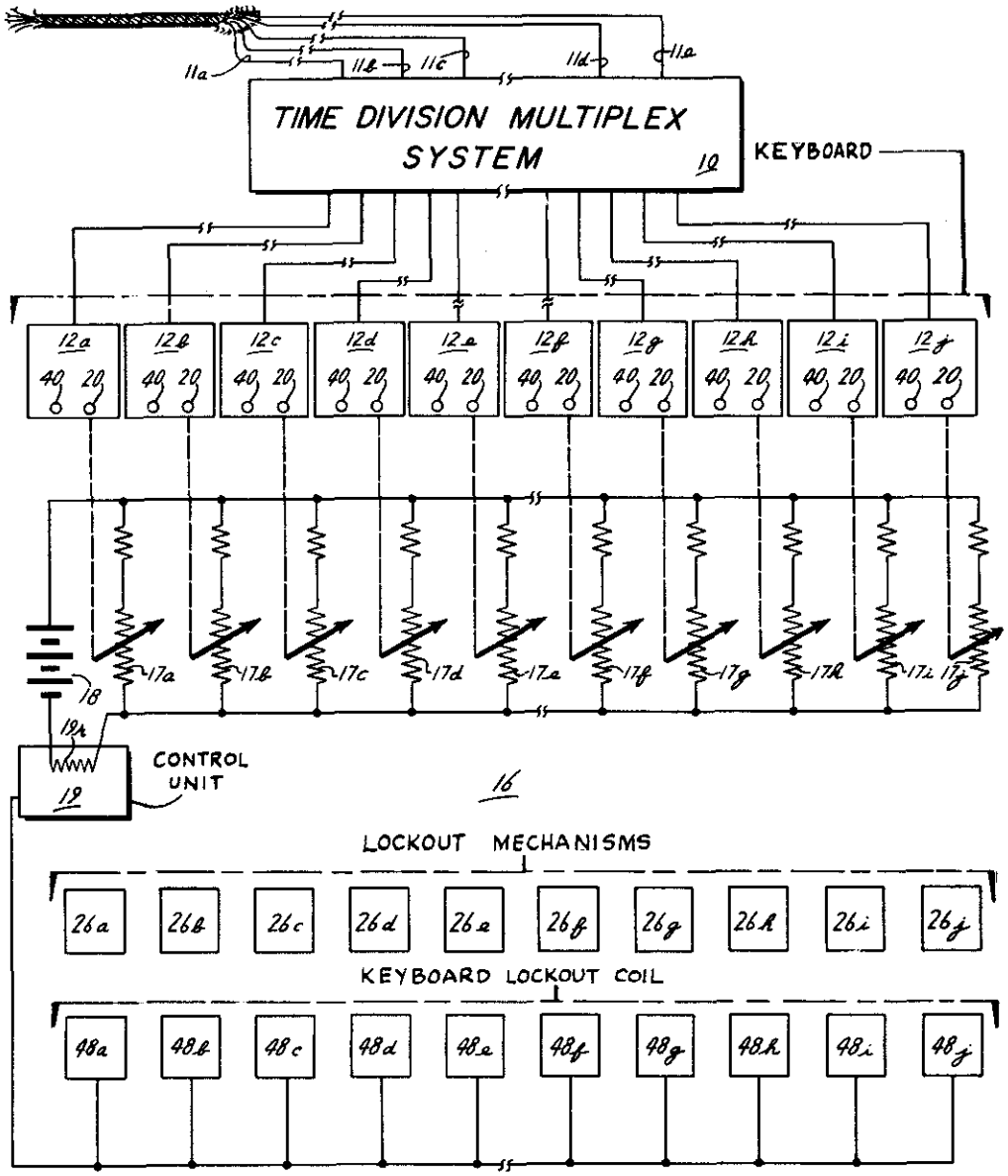

FIG. 1

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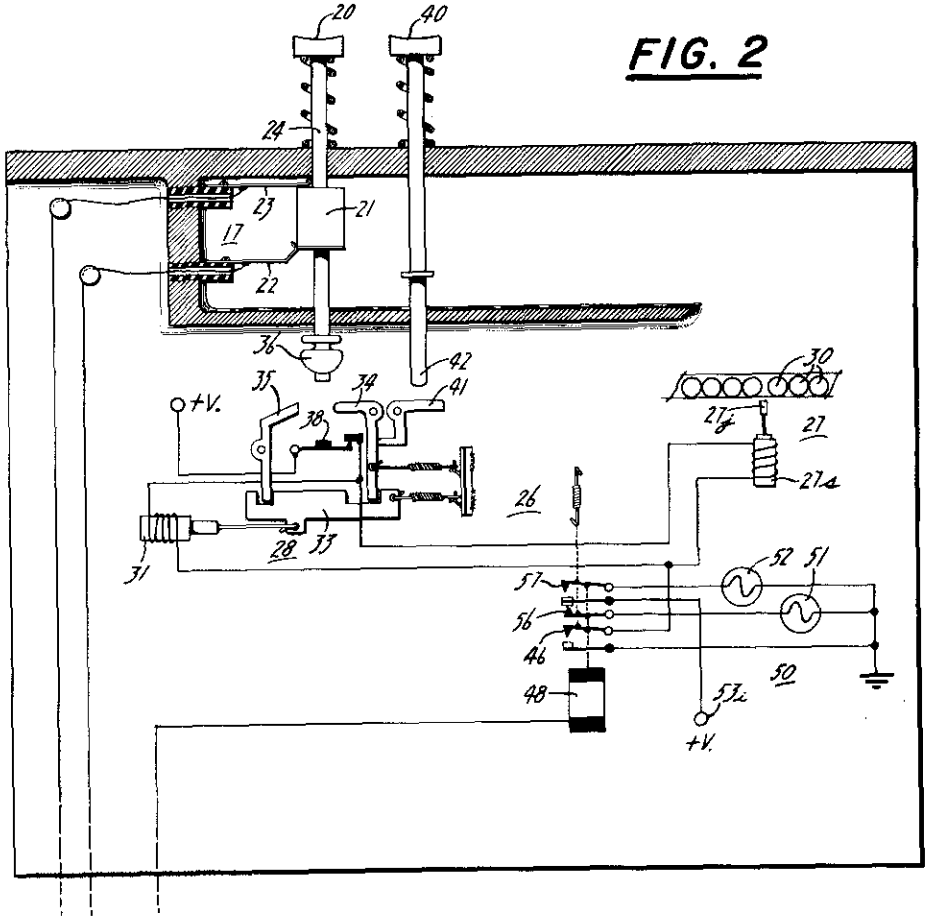
FIG. 2



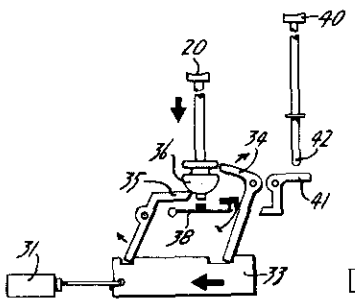


FIG. 3a

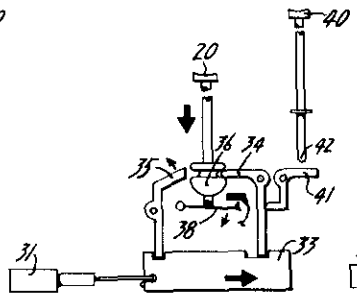


FIG. 3b

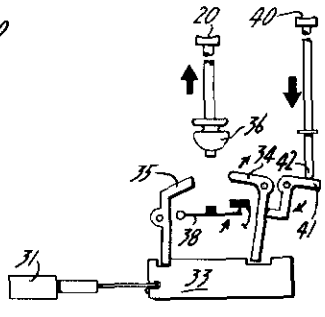


FIG. 3c

United States Patent Office 2,994,736 Patented Aug. 1, 1961

2,994,736

KEYBOARD ACCESS CONTROL SYSTEM

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Filed Dec. 23, 1957, Ser. No. 704,632
4 Claims. (Cl. 178—2)

This invention relates in general to time division multiplexing communication systems employing a number of keyboards for supplying intelligence to the communication channels, and in particular to a keyboard access control system for limiting the number of keyboards accessible to the multiplexing system at any given time.

In time division multiplexing communication systems the number of keyboards provided is usually in excess of the number of communication channels available, and hence a suitable arrangement must be provided for controlling the access of each keyboard to the system. The present invention provides a relatively simple and inexpensive solution to the problem and comprises a control circuit including a plurality of resistive units, each of which is associated with a different keyboard and variable from one position to another in response to actuation of a request key positioned on the associated keyboard. The resistive units are connected in parallel to a source of voltage through a control unit so that actuation of a predetermined number of these resistive units by their associated request keys causes operation of the control unit which causes a control signal to be supplied to each keyboard. A locking mechanism provided at each keyboard is operable in response to the control signal for preventing each of the remaining keyboards from obtaining access to the system.

It is therefore an object of the present invention to provide an improved keyboard access control system for a communication system employing a number of keyboards in excess of the number of available transmitting channels.

Another object of the present invention is to provide an improved keyboard access control system in which a control signal is generated in response to actuation of a predetermined number of keyboards.

A further object of the present invention is to provide a multiplexing communication system with a keyboard access control system employing a number of variable resistors, each of which is associated with a different keyboard and actuable from one position to another by a request key which guarantees access to the communication system, and means responsive to actuation of a predetermined number of request keys for rendering the actuation of the remaining request keys ineffective.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode which has been contemplated of applying that principle.

In the drawings:

FIG. 1 is a diagrammatic view of a multi-channel communication system embodying the access control system of the present invention.

FIG. 2 is a schematic view of a portion of one of the keyboards shown in FIG. 1.

FIGS. 3*a* through 3*c* are views illustrating the operation of the request key and locking arrangement shown in FIG. 2.

Referring to the drawings and particularly to FIG. 1, the system illustrated therein comprises a time division multiplexing communication system designated generally by reference character **10** and represented in block form. The communication system is shown for purposes of explanation as having five communication channels **11***a* through **11***e* and ten input keyboards **12***a* through **12***j*, each of which is operable to send information through the communication system. In practice, the communication system **10** would employ a much larger number of channels **11** and a proportionately larger number of keyboards **12**.

The communication system is provided with a control system **16** for limiting the number of keyboards **12** that may have access to the channels **11***a* through **11***e* at any particular time. The control system **16** comprises a plurality of variable resistive units **17***a* through **17***j* which are connected in parallel across a source of constant voltage (or current), shown as a battery **18**, through a control unit **19**. Each of the resistive units **17***a* through **17***j* is associated with a different keyboard **12** and is movable from one position to another in response to actuation of a request key **20** positioned on the associated keyboard **12**. Line drop compensating resistors may be connected in series with each of the resistive units **17** to balance the resistance of each parallel branch.

The arrangement of the request key **20** and the resistive unit **17** may be seen more clearly in FIG. 2 wherein the resistive unit **17** is shown as a strip or cylinder **21** of conductive plastic mounted for movement with the request key **20** and relative to a pair of wipers **22** and **23**, one of which engages the stem **24** of the request key **20** and the other of which engages the plastic strip **21**.

Referring again to FIG. 1, control unit **19** is responsive to the voltage across resistor **19***r* which, in turn, is responsive to the current through the resistive units **17***a* through **17***j*. The unit **19** turns on at a preset voltage value and turns off when the voltage drops below this value. Any suitable device known in the art, such as a contact making voltmeter, may be employed for unit **19**. The values of the resistive units **17***a* through **17***j* and **19***r* are chosen so that when a predetermined number of request keys **20** have been actuated, a voltage equal to the predetermined number of actuated request keys is reached and control unit **19** sends a control signal to operate a lockout mechanism **26** associated with each keyboard **12**.

The lockout mechanism **26** responsive to the control signal is shown in FIG. 2 in relation to the request key **20** and keyboard **12**. The mechanism **26** comprises a character key locking device **27** and a request key lockout device **28**. Character key locking device **27** comprises a solenoid **27***s* and an interposer **27***j*. Energization of the character key lock solenoid **27***s* prevents operation of the character keys on the keyboard by inserting the interposer **27***j* into the interlock discs **30** which are normally associated with the character keys for preventing operation of two character keys simultaneously. Character key locks are well known in the art and hence a detailed showing and description do not appear to be warranted.

The request key lockout device **28** comprises a solenoid **31**, a slider **33** movable by the solenoid **31**, and a pair of pivotable levers **34** and **35** positionable by slider **33**. Energization of the lockout solenoid **31** in response to signals from the control unit **19** moves slider **33** to the position shown in FIG. 3*a*, where the latching lever **34** is rendered ineffective to latch the distal end **36** of the request key **20**. Slider **33** also pivots stop lever **35** to a position which prevents the distal end **36** of the request key **20** from opening switch **38**.

The request key lockout device **28**, as shown in FIG. 2, is in the rest position, solenoid **31** being deenergized. In this position latching lever **34** is operable to engage the distal end **36** of the request key **20** in a latching relationship when the key **20** is actuated to the request position, as shown in FIG. 3*b*. Actuation of the request

key to the latch position opens switch **38** which renders the request key lockout device **28** and the character key locking device **27** ineffective or non-responsive to the signals from control unit **19**.

Means in the form of a release key **40** operates a release lever **41** to unlock the request key **20**. Upon actuation of the release key **40**, its distal end **42** causes a clockwise pivotable movement of release lever **41** which, in turn, pivots latching lever **34** clockwise to a non-locking position which allows the request key **20** to be returned to its normal position under the biasing action of spring **43**, as shown in FIG. 3*c*.

Energization of the character key lock solenoid **27***s* and the request key lockout solenoid **31** is controlled by contact **46** which is moved in response to energizaiton of coil **48** by signals from the control unit **19**. Closing of contact **46** completes a circuit from voltage terminal **53** to ground through both solenoids.

An indicating circuit **50** is also provided for giving a visual indication of whether or not access to the multiplexing communication system **10** may be obtained by actuation of the request key **20** on a selected keyboard. As shown, indicating circuit **50** comprises a ready lamp **51** and a busy lamp **52** connected to a suitable source of voltage represented by a terminal **53***i* through contacts **56** and **57**, respectively, which are operated jointly with contact **46** by coil **48**.

The operation of the control system is substantially as follows. Assuming that an operator desires to send a message from keyboard **12***a* and that none of the keyboards are in use, the request key **20***a* on the keyboard **12***a* is actuated from the position shown in FIG. 2 to that shown in FIG. 3*b*. Actuation of the request key **20***a* changes the conductance of the parallel branch containing resistive unit **17***a*, which results in a measurable change in current flowing through resistor **19***r*. Assuming further that unit **19** has been preset to operate in response to current in resistor **19***r* corresponding to the actuation of five request keys **20**, request key **20***a* is latched in position represented in FIG. 3*b* since solenoid **31** is deenergized. Switch **38** is open and the request key lockout solenoid **31** and character key lockout solenoid **27***s* are therefore non-responsive to any subsequent signals generated by control unit **19**. The operator may thereafter transmit his message to the multiplexing system in the normal manner. At the end of the message the release key **40** is depressed to the position shown in FIG. 3*c*, which causes request key **20** to return to its unactuated position shown in FIG. 2.

If, during the time keyboard **12***a* is in operation, other operators desire access to the system, the above described operations are repeated at each of the keyboards **12***b* through **12***e*. However, after the request key **20***e* on keyboard **12***e* is actuated, assuming that keyboard **12***e* is the fifth keyboard actuated, control unit **19** has reached its preset voltage value, which causes a latching signal to be sent to coils **48** associated with each of the keyboards.

Energizing of coil **48** causes contacts **46** and **57** to close. Closing of contacts **46***a* through **46***e* is ineffective to energize solenoids **27***s* and **31** associated with the keyboards **12***a* through **12***e*. However, closing of contacts **46** associated with remaining keyboards, namely, **12***f* through **12***j*, energizes each of the respective solenoids **27***s*, thereby locking the character keys of each keyboard **12***f* through **12***j*. In addition, closing of contacts **46***f* through **46***j* energizes the respective solenoids **31**, moving each of the sliders **33***f* to **33***j* to the lockout position and thereby rendering request keys **20***f* through **20***j* ineffective for guaranteeing access to the communication system **10**.

Contacts **57***a* through **57***j* are also operated in response to coils **48***a* through **48***j*, being energized by the control unit **19**, which in turn energizes the "busy" lights **52***a* through **52***j*, giving a visual indication to each keyboard that the system is operating to capacity.

When one of the operating keyboards **12***a* through **12***e* is finished with its message transmission and its release key **40** actuated, control unit **19** senses the change, so that transmission of the control signal is stopped. Contacts **46** are opened by a spring return, thereby deenergizing the solenoids **27***s* and **31** of the keyboards **12***f* through **12***j*, which allows another keyboard **12** to obtain access to the communication system upon actuation of its request key.

It will thus be seen that a relatively simple and inexpensive keyboard access control has been provided for a multiplexing communication system in which the number of keyboards exceed the number of available communication channels.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to the preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A keyboard access control system for a multichannel communication arrangement comprising in combination a plurality of keyboards each of which is provided with a request key actuable to one position to guarantee access to said communication arrangement, a locking mechanism engageable with said keyboard in response to a control signal for preventing operation of said keyboard and to render said request key ineffective, means for rendering said locking means ineffective in response to actuation of said request key to said one position, and an element for each of said keyboards for varying current from one value to another in response to actuation of said request key to said one position, a control unit, a source of voltage, means connecting said elements in parallel to said voltage source through said control unit, and means responsive to a predetermined condition of said control unit resulting from a predetermined number of said elements having said other current value for generating said control signal.

2. A keyboard access control system for limiting the number of keyboards simultaneously accessible to a multi-channel communication arrangement comprising in combination a plurality of keyboards each of which is provided with a request key actuable from one position to another, means engageable with said request key for locking said request key in said one position, lockout means operable in response to a control signal for rendering said locking means ineffective, keyboard locking means operable in response to said control signal for preventing operation of said keyboard, switch means responsive to actuation of said request key to said one position to render said lockout means and said keyboard locking means ineffective and a resistive unit variable from one value of resistance to another in response to actuation of said request key from said one position to another, and circuit means including said resistive units for generating said control signal in response to variations in the resistance values of a predetermined number of said resistive units corresponding to actuation of a predetermined number of said request keys.

3. The combination recited in claim 2 in which said circuit means comprises a control unit, a source of voltage and means connecting said resistive units in parallel across said voltage source through said control unit.

4. A keyboard access control system for a communication system comprising in combination a plurality of keyboards, each of which is provided with a request key operable in one position to guarantee access to said communication system, a plurality of resistive units each associated with a different said keyboard, means connected to each of said request keys for varying the resistance of its associated one of said units from one value to another in

response to actuation of the associated request key to said one position, means for generating a control signal in response to a predetermined number of said resistive units having said other value, locking means engageable with said keyboard in response to said control signal for rendering said keyboard inoperable, and means responsive to actuation of said request keys to said one position to render the associated locking means ineffective.

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