

June 3, 1969

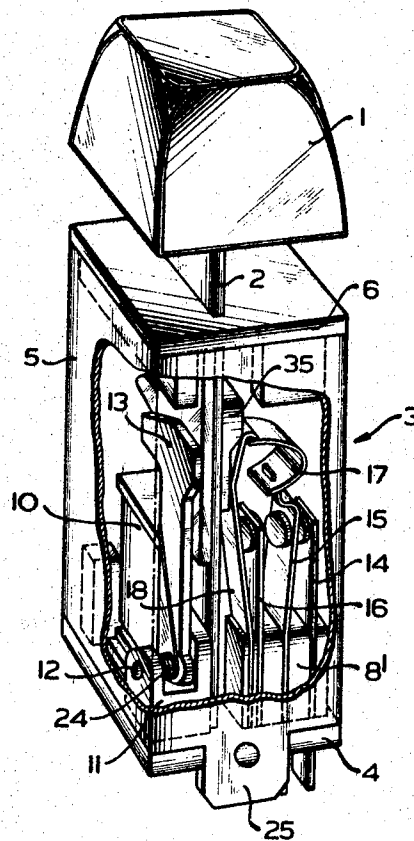
G. SCHILLER ET AL
KEY SWITCH ASSEMBLY

3,448,417

Filed Dec. 1, 1966

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FIG. 1



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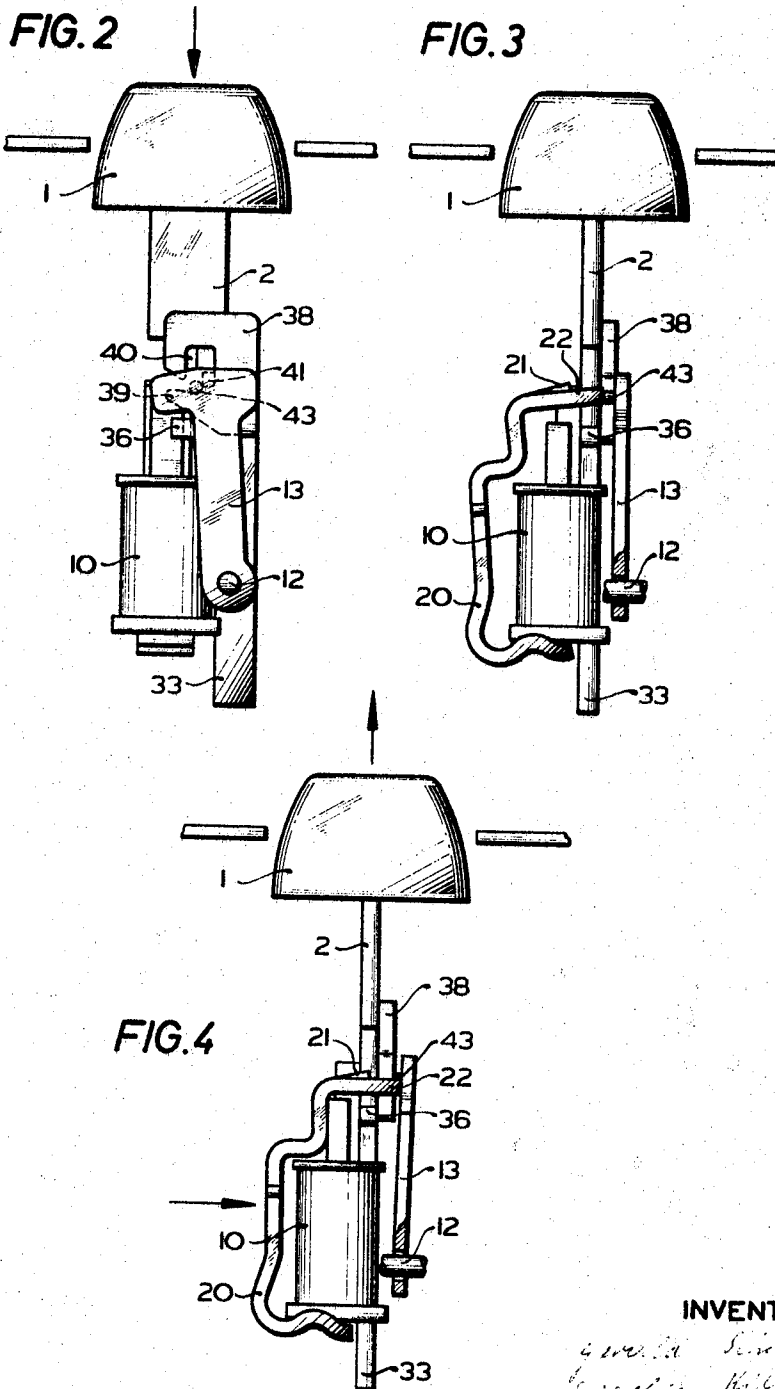
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FIG. 5

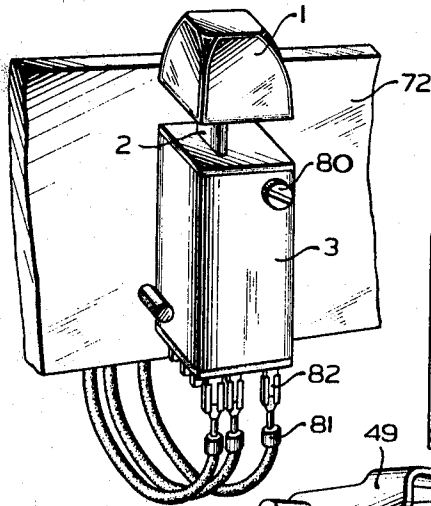


FIG. 6

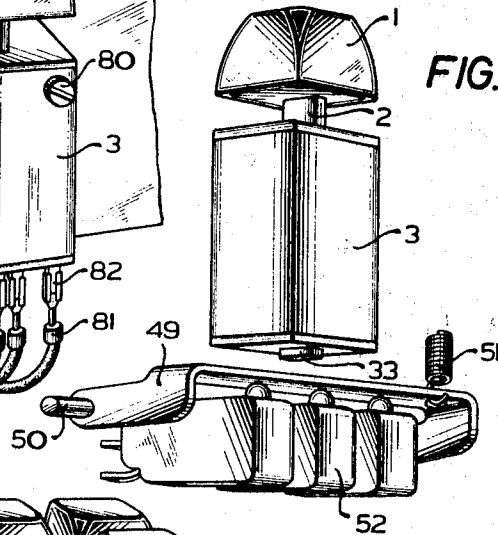
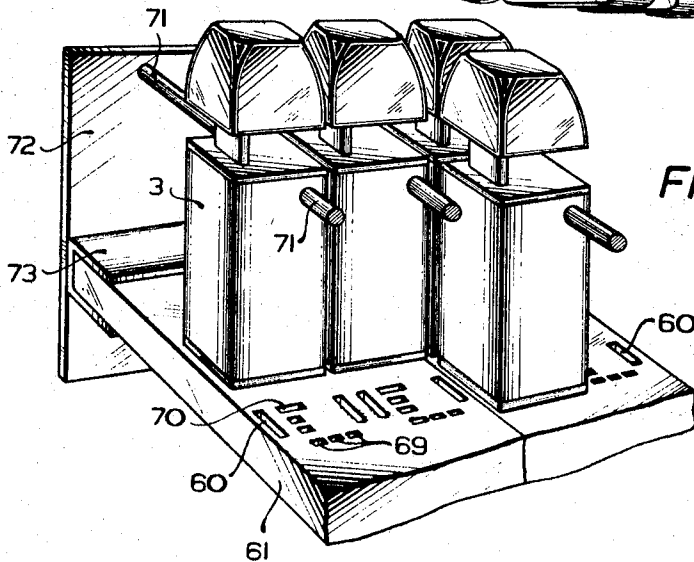


FIG. 7



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FIG. 8

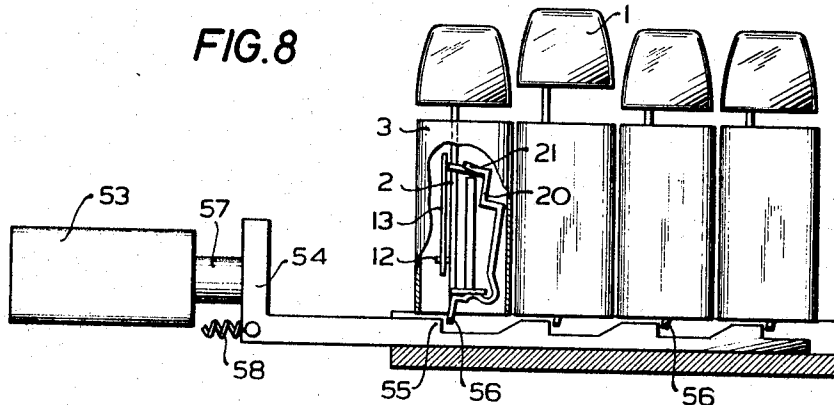


FIG. 9

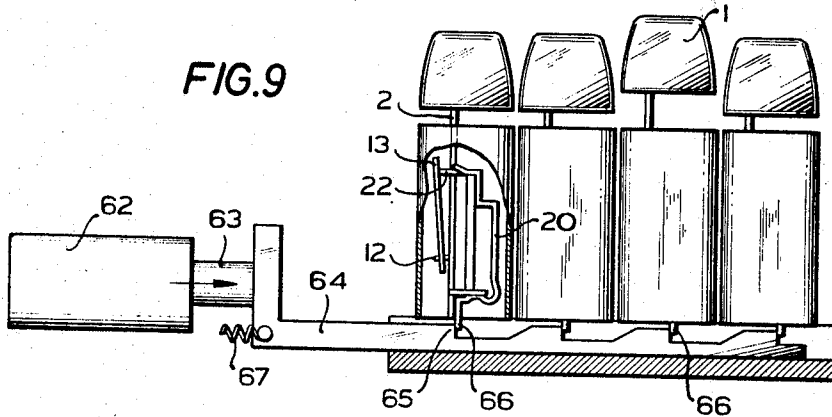
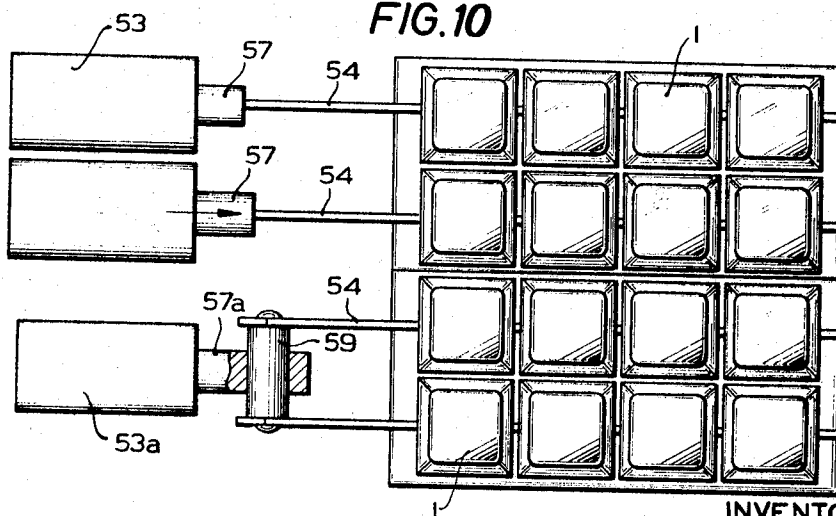


FIG. 10



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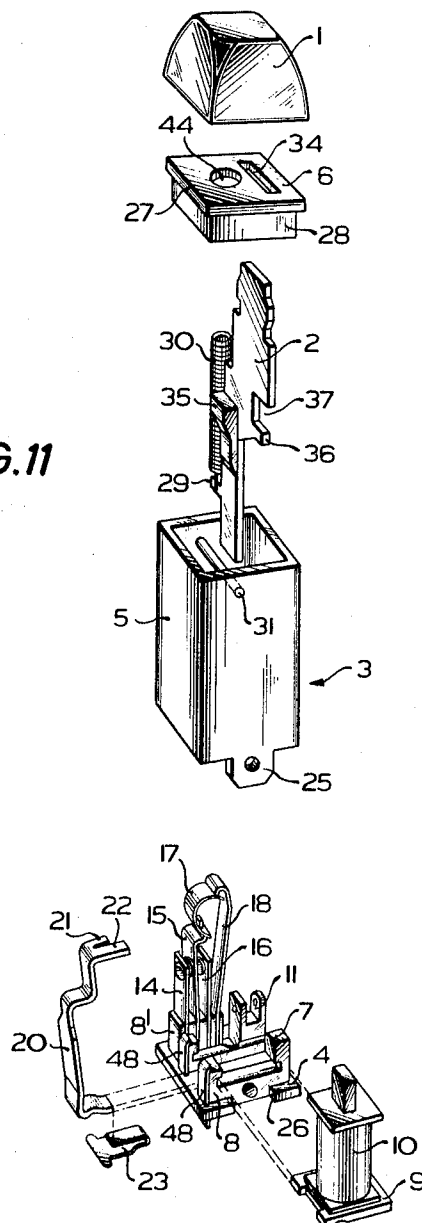
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FIG. 11



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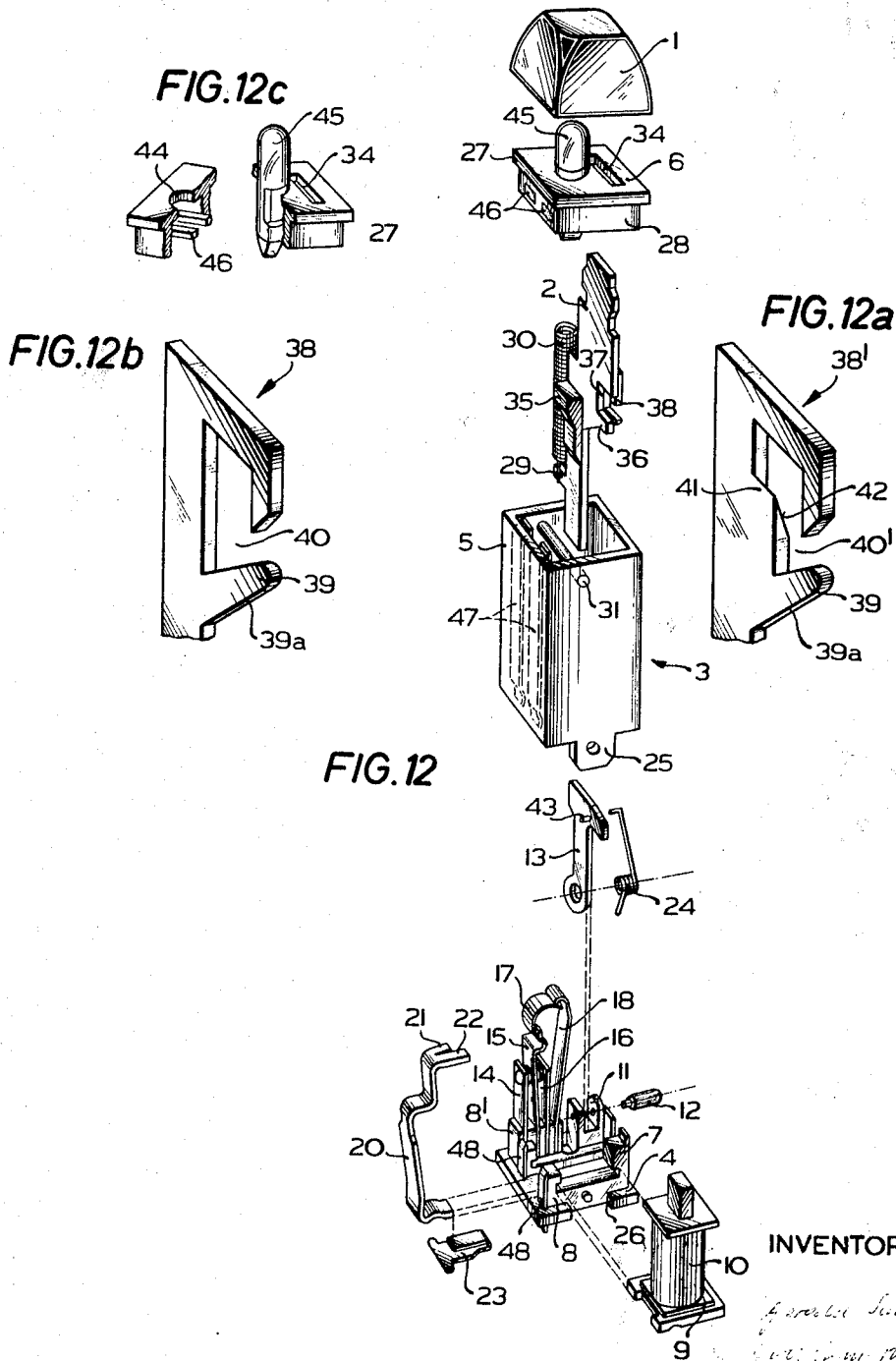
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KEY SWITCH ASSEMBLY

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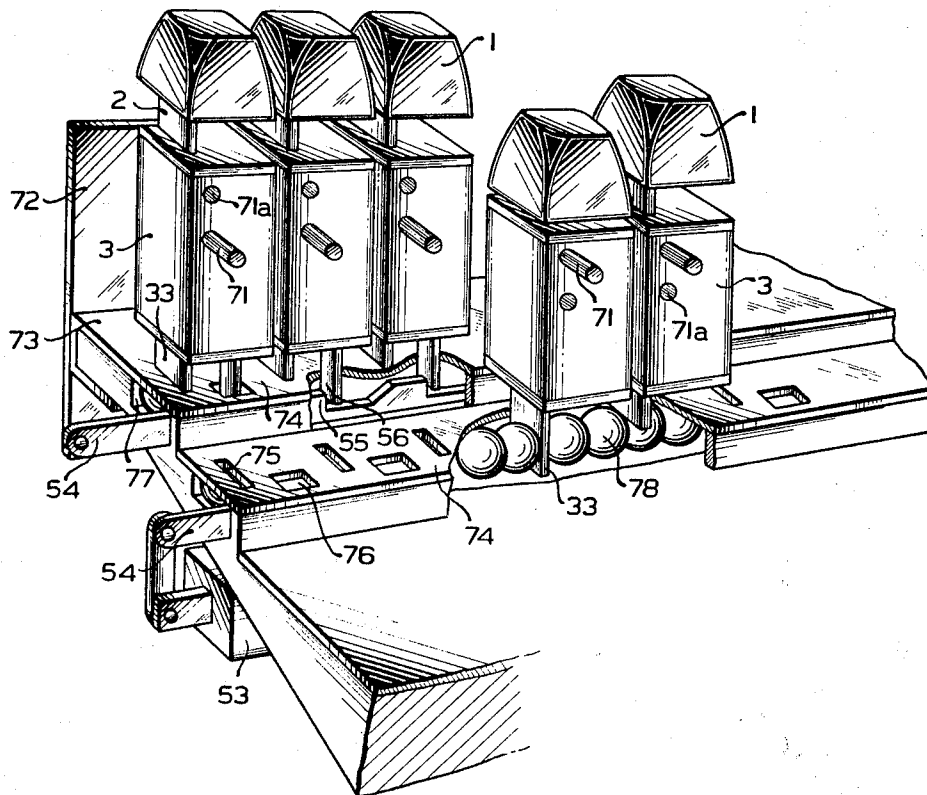
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FIG. 13



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KEY SWITCH ASSEMBLY

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Claims priority, application Germany, Dec. 1, 1965, K 57,793

Int. Cl. H01h 9/00, 9/26

U.S. Cl. 335—159

23 Claims

ABSTRACT OF THE DISCLOSURE

A key switch has a housing with a rectangular cross section so that key switches can be assembled in rows in a keyboard. Each key switch is assembled of components selected from a plurality of components having different functions and being attachable and detachable so that the components can be added to, or omitted from the key switch in accordance with selected functions which the key switch is to perform and all components are located within the housing.

Background of the invention

The present invention is concerned with switches, and more particularly with key switches of the type used in the keyboards of electronic or electromechanical accounting and data processing machines.

The keyboards of machines of this type are formed of keys which actuate one or several electric contacts in order to obtain in the respective accounting or data processing machine certain desired functions. Electric key switches are not only used for entering information, such as numbers and text, but also for producing command impulses by which different operations are initiated and terminated. In order to use the machines for different purposes and accounting situations, changes are very frequently required in the keyboard arrangement, and it is generally hardly possible to manufacture a large series of a particular machine with exactly the same keyboard. If all the possibilities afforded by the machine are to be used, it is necessary to construct the machine and the keyboards in such a manner that modifications of the keyboard, and particularly modifications of the functions obtained by several keys can be obtained.

For example, it may be required to provide keys by which contacts are operated, and other keys by which not only contacts are operated, but which are automatically locked in the operative contact-making position, and return to the position of rest only after the operation started by the actuation of the key has been automatically completed by the machine. Other keys are to be illuminated during the performance of an operation started by the respective keys. In other constructions, it is desired that several keys are simultaneously depressed by the operator to close corresponding contacts, and remain in the contact-closing position until simultaneously released for return to the position of rest. The function required of the keyboard depends to a great extent on the program which is to be carried out by the machine. This is the reason why if standard key switches performing certain functions are used, considerable changes of the key switches are required in order to permit operations and functions considered desirable by the organization which buys the machine.

Summary of the invention

It is an object of the invention to provide a key switch which can be adapted to perform different functions, and which can be assembled in rows of a keyboard. With this

object in view, a key switch is assembled of selected components in such a manner that it can be used for a particular purpose and function. If only a simple function is required, only a small number of components is combined, whereas for carrying out more complex functions, a greater number of components is combined. The arrangement is such that different groups of components can be put together for accomplishing different functions. The key switch and its components are constructed in such a manner that components can be easily added or omitted to the basic structure of the key switch. Any change required for adapting the key switch to particular functions, can be easily carried out by exchanging or adding components which are designed to be easily attached and detached to each other. A switch construction according to the invention comprising only a minimum of components preferably includes locking means for locking the key either in a position of rest or in the operative contact actuating position, and electric operating means for operating the locking means. When the key switch is manually operated, contacts are closed or opened, and when an electric control impulse is supplied to electric operating means, the key switch can be locked in the position of rest to prevent its operation, or in the operative position to hold the contacts in the actuated position until an operation has been performed by the machine. Simple key switches capable of performing these functions are particularly used as input keys for numerical values. The actuation of the contacts causes the entry of the numerical values into a register, and the locking of the keys is required to prevent the operation of the keys during the carrying out of the operation by the machine.

In a key switch combining a greater number of components, the key is locked in the operative position, and either released by further depressing the key, or by electromagnetic operating means under the control of an impulse, or in both manners.

In a further development of the invention, several key switches are arranged in rows and simultaneously locked and released. Another component can be added in the form of a signal lamp which illuminates the key either in the position of rest, or in the operative position in order to indicate the condition of the controlled circuit. Another component which can be added to the key switch assembly is a blocking arrangement by which simultaneous operation of several keys is prevented. The key switches are exchangeably arranged in rows or in crossing rows, and adjacent rows may be located at different levels as it is known for typewriter keyboards and calculator keyboards. Each key switch is enveloped by a dustproof casing protecting the contacts and abutting adjacent casings when the key switches are arranged in a single row or in crossing rows of the keyboard. The casings or housings have a rectangular cross section.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Brief description of the drawing

FIG. 1 is a perspective view illustrating an embodiment of the invention;

FIG. 2 is a fragmentary side view illustrating an operational position of the key switch;

FIG. 3 is a fragmentary front view illustrating the same operational position;

FIG. 4 is a fragmentary front view illustrating another operational position of the key switch;

FIG. 5 is a perspective view illustrating the support of a key switch;

FIG. 6 is a perspective view illustrating a modified contact arrangement of a key switch;

FIG. 7 is a fragmentary perspective view illustrating the mounting of a plurality of key switches;

FIG. 8 and FIG. 9 are fragmentary elevations, partially in section, illustrating common operating means for a plurality of key switches;

FIG. 10 is a fragmentary plan view, partially in section, illustrating simultaneous operation of a plurality of key switches by common electric operating means;

FIG. 11 is a perspective exploded view illustrating a key switch assembled of a small number of components;

FIG. 12 is a perspective exploded view illustrating a key switch assembled of a greater number of components;

FIG. 12a is a perspective view illustrating a locking member which may be used in the embodiment of FIG. 12;

FIG. 12b is a perspective view illustrating a simplified locking member which may be used in the embodiment of FIG. 12;

FIG. 12c is a perspective exploded view illustrating the assembly of a signal lamp; and

FIG. 13 illustrates a plurality of key switches mounted at different levels in a keyboard provided with blocking means permitting operation of only one key switch.

Description of the preferred embodiments

Referring now to the drawings, and more particularly to FIG. 1, the key switch has a stem 2 carrying a key 1 and being guided in slots of a casing 3 which has a bottom member 4, a top member 6, and four vertical side walls 5. As best seen in FIGS 11 and 12, two opposite walls 5 have projecting portions 25 received in corresponding cut-outs 26 in bottom member 4. Top member 6 has a top plate 27 which has the same circumferential outline as side walls 5, and a projection portion 28 which fits into the opening formed by the upper ends of side walls 5. Due to this construction, the casing can be assembled without the use of screws or bolts. The construction of top member 6 is also shown in FIG. 12c which shows that a signal lamp 45 can be mounted in a circular opening 44 in top plate 27, which also has a rectangular slot 34 for guiding stem 2. Signal lamp 45 is located in the hollow interior of key 1 which is made of a light permeable material.

As best seen in FIGS. 11 and 12, bottom member 4 is constructed with mounting means to permit the assembly of different parts of the key switch without the use of screws or bolts, so that each part can be easily attached to bottom member 4, or removed from the same if a particular function carried out by the respective part is not necessary or desired. A projecting part 8' of bottom member 4 has a plurality of recesses into which contacts 14, 15, 16 and a switch actuator spring 18 are inserted. A greater or smaller number of recesses may be provided for receiving a greater or smaller number of contacts. Contact 15 is connected by a crescent-shaped spring 17 with actuator 18 so that upon operation of actuator 18, contact 15 snaps either into one position engaging contact 14, or into another position engaging contact 16.

A projecting actuating portion 35 is secured to stem 2, and engages actuator spring 18 when key 1 with stem 2 is depressed from its normal position of rest to the operative position shown in FIG. 2. Actuator portion 35 has a slanted face for gradually displacing actuator spring 18.

Bottom member 4 has a guide portion including a pair of guide arms 7 and 8 forming a guideway for mounting the base plate 9 of an electromagnetic operating means 10 so that the same can be easily secured to or detached from bottom member 4. Electromagnetic operating means 10 has an armature 20 which can be hooked into a corresponding cut-out in bottom member 4 located under the base plate 9. A spring 23 is located under armature 20 and urges the same to turn in counterclockwise direction to the position shown in FIG. 3. The upper end of

armature 20 has a locking portion 21 and a releasing portion 22. Locking portion 21 is shorter than releasing portion 22 and is slanted to project above the same. When electromagnetic operating means 10 is energized, armature 20 is actuated to turn in clockwise direction against the action of spring 23 from the position of FIG. 3 to the position of FIG. 4.

Bottom member 4 has two integral supporting brackets 11 formed with aligned bores into which a pivot 12 is inserted. A locking pawl means 13 is mounted on pivot 12 for angular movement, and includes a projecting locking pin 43. A spring 24 has a central coiled portion mounted on pivot pin 12, and two arms respectively abutting locking means 13 and bottom member 4 so that locking pawl means 13 is urged by spring 24 to turn in clockwise direction, as viewed in FIG. 2, to a position in which locking pin 43 engages a slanted cam face 39a of a portion 39 of a locking member 38 shown in FIG. 12b which in modified form 38' is shown in FIG. 12a. Either locking member 38 or locking member 38' is attached to key stem 2 for performing desired and selected functions.

Stem 2 has a hook 29 to which the lower end of a coil spring 30 is attached, as shown in FIGS. 11 and 12. The upper end of spring 30 is attached to a rod 31 passing through aligned bores in opposite side walls 5 of the casing 3. Spring 30 urges stem 2 with key 1 to a normal position of rest, and is tensioned when key 1 is depressed and moved to an operative position in which actuator portion 35 operates contacts 14 to 17.

Stem 2 has a locking projection 36 cooperating with locking portion 21 of armature 20.

When electromagnetic operating means 10 is energized by a control impulse, which may be transmitted from a remote station, and attracts armature 20 in clockwise direction, locking portion 21 is placed below locking projection 36 if key 1 is in the position of rest, so that movement of key 1 to its operative position is prevented since locking projection 36 engaging locking portion 21 locks stem 2 and key 1 in the upper position of rest. Locking projection 36 has such a length that it abuts only locking portion 21, but does not engage releasing portion 22.

Stem 2 has a recess 37 directly above locking projection 36. If instead of locking of key 1 in the position of rest, locking of key 1 in the operative position is desired, electromagnetic operating means 10 is energized by an impulse when key 1 is depressed, so that locking portion 21 enters recess 37 and prevents upward movement of key 1 under the action of spring 30 by engaging locking projection 36.

If desired for performing additional functions, either locking member 38 or locking member 38' is attached to the right side of stem 2. Locking member 38 is C-shaped and has a lower locking portion 39 bounding a cut-out or recess 40 whose configuration matches recess 37 in stem 2 so that the cut-outs 37, 40 are aligned.

The locking member 38' shown in FIG. 12a has an inner projection 41 with a slanted lateral guide face 42 which is located on the side of locking member 38' remote from stem 2.

Two terminals 48 are attached to base member 4 and pass through slots of the same so that wires can be secured to the downwardly projecting terminal portions. When base member 4 is attached to casing 5, terminal contacts 48 engage corresponding contact rails 47 attached to the inner surface of the casing. The ends of contacts 47 engage the ends of two contacts 46 in top member 6 when the same is attached to the upper end of casing 3. Contacts 46 engage the terminals of the signal lamps 45 when the same is inserted into the opening 44 of top member 6, as best seen in FIGS. 12 and 12c. Contacts 14, 15, and 16 have lower ends projecting through slots from the bottom face of the bottom member 4, and serving as terminals. Two additional contacts, not shown, pass through slots in bottom member 4 and engage correspond-

ing contacts of electromagnetic operating means 10 when the same is attached to the bottom member.

Due to the fact that all components of the key switch are detachably attached to each other and to the supporting casing 3, as many components are put together as necessary for the particular functions which the key switch is to perform in a particular circuit.

A minimum of components is required for performing two basic functions, namely the operation of contacts by the key, and the locking of the key in its position of rest. The components required for performing these functions are assembled as shown in FIG. 11. The electric operating means 10 controls the armature 20 whose locking portion 21 cooperates with locking projection 36. Assuming that electric operating means 10 is not energized by a control impulse, armature 20, 21 will be in an inoperative position, and when key 1 is manually depressed with stem 2 and actuator portion 35, the latter engages the actuator spring 18, 17 by which contact 15 is displaced to be connected with contact 14. Upon release of key 1, it is returned by spring 30 to its position of rest. However, if electric operating means 10 is energized by a control impulse, the armature 20 is attracted in clockwise direction and locking portion 21 is located under locking projection 36 so that key 1 cannot be depressed, and cannot assume its operative position in which contacts 14, 15 and 16 are operated. It is evident that different contact combinations can be used which may comprise a greater number of contacts, and be operated in a different manner by the actuator portion. For example, a plurality of normally closed contacts may be opened, or a plurality of normally open contacts may be closed when key 1 and stem 2 with actuator portion 35 are moved to the operative position.

In the modified embodiment shown in FIG. 6, the actuator portion 35 may be omitted, and the lower end portion 33 of stem 2 operates a U-shaped member 49 which is mounted on a shaft 50 for angular movement and is biased by spring 51. When key 1 is depressed, the end portion 33 presses member 49 downward to a position engaging the actuator buttons of a series of microswitches 52.

The locking of a single key in the position of rest by electric operating means 10 has been described with reference to FIG. 11, but it is also possible to arrange the key switches in groups, and provide common electromagnetic operating means for the switches of the group.

FIGS. 8 and 9 illustrate an arrangement in which a single row of key switches is provided. Each key switch includes the above-described armature member 20 which, however, in this arrangement is not the armature of an electromagnet, and has a downwardly projecting engaging portion 56. All engaging portions 56 of one row of key switches cooperate with a common operating member 54 which is secured to the armature 57 of an electromagnetic operating means 53 which, when energized, moves operating member 54 to the right viewed in FIG. 8 against the action of spring 58 to shift all components 20 to the position shown in FIG. 9. Operating member 54 has a plurality of recesses bounded by shoulders 55 which cooperate with engaging portions 56.

In the event that a key 1 is depressed, locking portion 21 enters locking recess 37 when electric operating means 53 receives a control impulse, and locks key 1 in the operative position. When another key of the row is in the position of rest, as shown for the second key from the left in FIG. 8, locking portion 21 moves to a position located under locking projection 36, and prevents operation of the respective key as long as the impulse energizes electric operating means 53. Component 20 can be used as a locking means as described with reference to FIG. 8, or as a locking means and armature, as described with reference to FIG. 11.

FIG. 10 illustrates an arrangement whose components and functions are the same as described with reference

to FIG. 8, and two single rows operated by two electric operating means 53, as described with reference to FIG. 8, are shown in the upper portion of FIG. 10. The lower portion of FIG. 10 shows two rows of key switches whose locking means are controlled by two operating members 54 which are connected by bolt 59 passing through a bore in armature 57a of electric operating means 53a. The four key switches of these two rows are simultaneously locked and unlocked under the control of electric impulses supplied from a remote point to the electric operating means.

In the above described embodiment in which a minimum of components is used, the key switch is movable between a position of rest and an operative position, and can be locked either in the position of rest or in the operative position, but if it is locked in the operative position, it returns immediately to the position of rest when the control impulse energizing the electric operating means terminates.

If the key switch is to remain in its operative position until either an electric, or a manual impulse is given, additional components have to be added. Locking means 13, 43 is mounted on pivot pin 12 together with spring 24, and either locking member 38 or locking member 38' is secured to stem 2.

If locking member 38 shown in FIG. 12b is used, and attached to stem 2 in a position in which its recess 40 registers with recess 37, the key is locked in the operative depressed position. When stem 2 with locking member 38 moves downward, the guide face 39a engages locking pin 43 and displaces locking means 13 about pivot 12 in clockwise direction as viewed in FIG. 2, which, however, does not show this position of the locking means. When key 1 is further depressed and pin 43 can move around the free end of portion 39, spring 24 urges locking means 13 to turn in counterclockwise direction so that locking pin 43 moves into recess 40 to the position shown in FIG. 2 so that key 1 and stem 2 are locked in the operative position in which the contacts 14, 15 and 16 are operated. It will be noted that armature 20 and locking portion 21 are not used for this locking operation. Electric operating means 10 and armature 20 are used for releasing key 1 so that the same may return to its position of rest.

When an electric control impulse is received by electric operating means 10, armature 20 is operated and turns in clockwise direction from the position of FIG. 3 to the position of FIG. 4 in which releasing portion 22 of armature 20 engages locking pawl means 13 and turns the same out of its normal locking position shown in FIG. 3 in which locking pin 43 is located in recess 40, to the tilted releasing position shown in FIG. 4 in which locking pin 43 is located outside of recess 40 and laterally of the same so that locking member 38 is no longer locked and spring 30 can return key 1 with stem 2, actuator portion 35, and locking member 38 to the higher position of rest. Locking pawl means 13 is mounted on pivot 12 in such a manner that it can not only be turned about the axis of pivot 12, but also tilted to the position shown in FIG. 4.

It will be seen that the addition of locking components 38 and 13 to the key switch renders the same capable of performing an additional function, namely automatic locking of the key switch in the operative position, and release of the key switch upon receipt of an electric control impulse. A key switch having these components and performing these functions may be used, for example, in a calculator in which the key is manually operated, and remains in the operative position until a calculating operation is automatically carried out by the machine, whereupon at the end of the calculating operation an impulse is supplied to the electric operating means 10 to release the key 1 for return to its position of rest.

As explained with reference to the embodiment of FIGS. 11 and 8, a group of key switches, provided with

the additional components 13 and 38, may be combined and simultaneously released by a control impulse. As shown in FIG. 9, the electric operating means 62 has an armature 63 secured to an operating member 64 which has shoulders 65 cooperating with engaging portion 66 of armature 20, and being biased by a spring 67. Assuming that several keys of the group are depressed and in the operative position, a control impulse received by electric operating means 62 causes shifting of armature 63 and operating member 64 to the right in the direction of the arrow against the action of spring 67 so that all components 20 are turned in counterclockwise direction as viewed in FIG. 9, and in clockwise direction as viewed in FIG. 12 to a position in which releasing portion 22 engages locking pawl means 13 and move the same to a tilted releasing position shown in FIG. 4. If one of the key switches is in the position of rest, releasing portion 22 passes under projecting portion 39 of locking member 38 and tilts locking pawl means 13 without any effect since locking pin 43 is not located in recess 40 of locking member 38.

If locking member 38' shown in FIG. 12a is used together with locking pawl means 13 as additional components, the release of a key switch locked in the operative position can be obtained by a second depression of key 1.

When key 1 is depressed to its operative position, locking pin 43 moves along the slanted bottom face 39a and about the end of portion 39 into recess 40, as described with reference to FIGS. 2, 3 and 12b, so that the key is locked in the operative position.

In order to effect a manual release of the key, key 1 is further depressed to a lower position so that locking pin 43 assumes a position located in the upper portion of recess 40' above the edge 41 formed by the slanted guide face 42. In this third position of the key, the same is not locked against upward movement to the operative position since pin 43 is spaced from the upper face of projection 39. Consequently, when the operator manually releases the key, it is moved upward by spring 30 together with locking member 38' so that the end of locking pin 43 is engaged by the slanted guide face 42 and is urged laterally out of recess 40 while locking pawl means 13 assumes the tilted position shown in FIG. 4 in which the end face of locking pin 43 slides on the lateral face of locking member 38' so that projection 39 cannot be engaged and locked by locking pin 43. Consequently, key 1 with stem 2 and locking member 38' move upwards through the operative position to the position of rest.

Since the armature 20 with releasing portion 22 can be operated when locking member 38' is used in the same manner as when locking member 38 is used, it is evident that release of the key can be effected not only by further depression of key 1, but also by an impulse received by electromagnetic operating means 10 and causing the movement of armature 20 to the position of FIG. 4.

A further component of the key switch is the signal lamp 45 which is connected into the circuit by simply inserting the same into the opening 44 so that its socket establishes contact with contact springs 46. It is evident that the signal lamp component can be added to a switch as shown in FIG. 11 including only a minimum of components, as well as to the switch shown in FIGS. 12 and 12a, comprising a greater number of components and capable of performing the additional locking and releasing functions described above. The current for the signal lamp is supplied through the contact members 46, 47, 48. In the arrangement of FIG. 11, the contacts of the signal lamp may be closed by a relay having a holding contact.

The combination of components described with reference to FIGS. 12 and 12a can also be used to obtain a different function of the key switch. In some circuits,

it is necessary that key 1 is locked in the operative depressed position upon receipt of a control impulse from a remote point, and is released by manual operation. Key 1 is depressed to the operative position, and when the electric operating means 10 is energized and armature 20 turned in clockwise direction, locking portion 21 enters recess 37 and locks key 1, while releasing portion 22 renders locking means 13 inoperative. The key is thus locked in the operative position by locking portion 21 until the control impulse terminates and armature 20, 22 returns to its inoperative position, permitting locking pin 43 to enter recess 40' and to lock key 2 by engaging the upper face of locking portion 39. When key 1 is now further depressed, the edge 41 is placed in the region of locking pin 43, and upon release of the key, guide face 42 displaces locking pin 43 as described above to permit return of the key to the position of rest.

In a further modification, electric operating means 10 is connected with contacts 14, 15 and 16 and is energized when the contacts are operated in the operative depressed position of key 1. The energized electric operating means 10 moves armature 20 with locking portion 21 to the locking position, as explained above. When the current flowing through electric operating means 10 is interrupted by opening of a switch at the remote station, armature 20 moves to its inoperative position so that the key is no longer locked by locking portion 21, but is locked by locking pin 43. The release of the key for movement to the position of rest is then effected by depressing key 1 further to a third position for displacing locking pin 43 by guide face 42.

As explained with reference to FIGS. 8, 9 and 10, a plurality of key switches may be combined in groups or rows. A particularly advantageous construction is illustrated in FIG. 7. A supporting socket plate 61 has cut-outs 60 for receiving the pair of supporting ears 25 of each key switch casing 3, socket recesses 69 provided with contacts and receiving the terminal end portions of contacts 14, 15 and 16, which project downwardly below the bottom member 4, and another cut-out 70 for the engaging portion 56 of component 20 in the arrangement described with reference to FIGS. 8 to 10. Other socket recesses with contacts receive the terminals of contact members 48 which supply current to the signal lamp 45. In order to mechanically connect rows of key switches, casings 3 have aligned bores in opposite side walls through which rods 71 are inserted. The ends of the rods are secured to vertical support plates 72 which carry channels 73 in which the socket plate 61 is mounted. While FIG. 7 shows only one set of parallel rods 71, it is possible to provide the corresponding set of transverse rods for more rigidly connecting the casings of the key switches.

In the modified arrangement illustrated in FIG. 13, each casing 3 has pairs of aligned bores 71a at different levels, permitting the mounting of rows of key switches at different levels, as is customary in keyboards of typewriters and calculators. The supporting wall 72 carries a channel-shaped frame 73 supporting stepped plates 74 which have cutouts 75 for the lower end portions of stems 2. Cut-outs 76 receive the engaging portion 56 of armature components 20, as described with reference to FIGS. 8 to 10. Cut-outs 76 have sufficient width to permit a movement of engaging portions 56 under the control of locking member 54. Channels 77 receive rows of balls 78 and are closed at the ends so that the row of balls 78 leaves just sufficient room for one stem of a depressed key. As long as one key is depressed and the balls spread into tightly abutting positions, no other key can be operated since the lower end portion 33 of its stem 2 cannot force the balls apart. The locking member 54, 55, described with reference to FIG. 8, are mounted in corresponding slots of the support plate 53 and are controlled on operate engaging portions 56 of the armature components 20.

Another arrangement for mounting the key switches

is shown in FIG. 5. The supporting plate 72 has threaded bores into which screws 80 passing through bores in casing 3 are threaded. The socket plates of FIGS. 7 and 13 are not required in the embodiment of FIG. 5, and connectors 81 have individual sockets 82 which are pushed over the terminals projecting from the bottom face of bottom member 4.

From the above described embodiments and arrangements of the invention, it will become apparent that the key switch of the invention can be modified by using selected components, and is capable of performing different functions in accordance with the selected components so that basically the same key switch can be adapted to perform different functions, as required.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of switching arrangements differing from the types described above.

While the invention has been illustrated and described as embodied in a key switch assembled of selectable components in accordance with desired functions, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims:

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

We claim:

1. Key switch assembly comprising at least one supporting means; at least one row of key switches, each key switch comprising a housing having a rectangular cross section and including two pairs of opposite side walls extending in the longitudinal direction of said row and transverse to the same, respectively, and end wall means bounding the interior of said housing, said housings being detachably attached to said supporting means for removal and replacement; contact means in said interior of said housing; first mounting means in said interior and secured to said housing; a manually operated key supported on said first mounting means for movement between a normal position and an operative position for actuating said contact means, and including a key stem and a key button secured to said key stem outside of said interior and having longitudinal and transverse dimensions substantially equal to the distances between said side walls of said pairs; and second mounting means within said interior secured to said housing for mounting locking means for said key means within said interior so that the components of each switch are located within said housing.

2. Key switch assembly as claimed in claim 1 wherein said cross section is substantially square; wherein said longitudinal and transverse side walls are spaced substantially the same distance; and wherein the transverse and longitudinal dimensions of said key button are substantially the same as said distance.

3. Key switch assembly as claimed in claim 1 comprising locking means mounted in said interior on said second mounting means and including a locking pawl operable for locking and releasing said key stem, and electromagnetic means including an armature for locking said key stem and for operating said locking pawl.

4. Key switch assembly as claimed in claim 3 wherein said electromagnetic means include coil means, and a supporting base for said coil means; and wherein said second mounting means include guide means for slidably guiding said base so that said electromagnetic means can be mounted in said housing and removed from the same.

5. Key switch assembly as claimed in claim 4 wherein said end wall means includes a bottom wall on which said guide means are mounted, said bottom wall having an opening, and wherein said electromagnetic means includes a C-shaped armature having a portion cooperating with said coil means, a portion for engaging said key stem, and a portion for engaging said locking pawl.

6. Key switch assembly as claimed in claim 1 wherein said stem has a locking projection; comprising locking means mounted in said interior on said second mounting means and including electromagnetic means, and an armature cooperating with said locking projection and having a locking position located on one side of said locking projection in said normal position, and on the other side of the same in said operative position so that said key is locked when said electromagnetic means is energized in either position of said key.

7. Key switch assembly as claimed in claim 6 comprising a locking member having a cam portion and a locking recess and being secured to said key stem, wherein said locking means include a locking pawl mounted on said second mounting means, and a spring biasing said locking pawl; wherein said cam portion of said locking member displaces said locking pawl during movement of said key stem to said operative position so that locking pawl engages said recess in said operative position and locks said key; wherein said armature has a releasing position for displacing said pawl to release said locking member; and wherein said electromagnetic means moves said armature to said releasing position when energized.

8. Key switch assembly as claimed in claim 7 wherein said second mounting means include a pivot means supporting said locking pawl for turning movement in one direction when displaced by said locking member, and for tilting movement in another direction when displaced by said armature.

9. Key switch assembly as claimed in claim 8 wherein said locking pawl has a projecting pin cooperating with said cam portion so that said locking pawl turns about the axis of said pivot means when said key stem moves to said operative position; and wherein said locking pawl is mounted with play on said pivot means and is tilted by said armature in said other direction on said pivot means to release said locking member.

10. Key switch assembly as claimed in claim 9 wherein said locking recess in said locking member has a slanted guide face; wherein said key is manually movable to a releasing position beyond said operative position, said pin engaging said slanted guide face in said releasing position so that said locking pawl is moved by said slanted guide face to a position releasing said locking member when said key returns to said operative position.

11. Key switch assembly as claimed in claim 1 wherein said key stem has a slanted actuator portion consisting of insulating material; wherein said contact means include an actuator spring and a plurality of contacts displaced by the same; and wherein said actuator portion engages said actuator spring in said operative position for operating said contacts.

12. Key switch assembly as claimed in claim 11 wherein said key button is hollow and light permeable; wherein said end wall means include an end wall closing said housing under said key button; comprising a signal lamp mounted on said end wall under said key button, and conductor means connecting said signal lamp with said contacts so that said signal lamp is illuminated when said key is in said operative position.

13. Key switch assembly as claimed in claim 1 wherein said housing end wall means include a top wall under said key button, and a bottom wall; and wherein said first and second mounting means are parts of said bottom wall.

14. Key switch assembly as claimed in claim 13 comprising terminals connected with said contact means and

mounted on said bottom wall downward projecting from the same.

15. Key switch assembly as claimed in claim 1 wherein said key stem has a locking portion projecting in said operative position from the interior of said housing at the end of said side walls remote from said key button; and comprising a locking means and electromagnetic operating means for operating said locking means to engage and lock said locking portions of said key stems of said key switches of said row.

16. Key switch assembly as claimed in claim 1 wherein said key stem has an end portion; and comprising a ball locking means extending along said row of key switches and cooperating with said end portions of said key switches of said row in said operative position so that only one key can be moved to said operative position.

17. Key switch assembly as claimed in claim 1 wherein said key stem has an end portion; and comprising a plurality of micro switches operated by said end portion in said operative position of said key.

18. Key switch assembly as claimed in claim 1 wherein said housing includes mounting projections at the end remote from said key button; and comprising a support plate having socket recesses receiving said mounting projections so that said row of key switches is mounted on said support plate.

19. Key switch assembly as claimed in claim 1 wherein at least said transverse side walls have aligned bores therethrough; and comprising rods passing through said aligned bores for attaching said key switches of said row to each other.

20. Key switch assembly as claimed in claim 1 wherein each longitudinal side wall has a plurality of bores therethrough disposed at different levels, wherein said bores are aligned at each level; and comprising rods passing through aligned bores at different levels so that said key switches are mounted at different levels.

21. A key switch comprising a housing having a rectangular cross section and including four side walls, a top wall, and a bottom wall; contact means including a plurality of contacts and an actuator spring mounted on said bottom wall; a manually operated key including a key button, and a key stem guided in said top and bottom walls so that said key is movable between a normal position and an operative position engaging said actuator spring for operating said contacts, said key stem having a locking projection; locking means including an electromagnet and an armature detachably mounted on said bottom plate and moved by said electromagnet between an inoperative position, and a locking position engaging said locking projection, said armature being located on

opposite sides of said locking projection in said normal and operative positions of said key and locking the same against movement from the position thereof in which said electromagnet was energized to the respective other position.

22. A key switch as claimed in claim 21 wherein said key includes a locking member secured to said key stem and having a cam portion and a locking recess; and wherein said locking means includes a locking pawl, a pivot on said bottom plate supporting said locking pawl for pivotal movement between an inoperative position and a locking position engaging said locking recess, and also tiltably supporting said locking pawl for movement out of said locking recess, and a spring urging said locking pawl into said locking recess; wherein said cam portion engages said locking pawl during movement of said key to said operative position and moves said pawl to said locking position so that said locking pawl engages said locking recess and locks said key in said operative position; and wherein said armature has a releasing portion engaging said locking pawl in said locking position when said armature is displaced by the energized electromagnet to tilt said locking pawl to move out of said locking recess and to release said key.

23. A key switch as claimed in claim 22 including terminals projecting through said bottom plate and being connected with said contacts and with said electromagnet, respectively; conductor means extending along a side wall and connecting said contacts with said top wall; a signal lamp mounted on said top wall for illuminating said key button and connected with said conductor means so that said signal lamp is lighted when said key is in said operative position.

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