United States Patent

Feder

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[54] KEY OPERATED SWITCH

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[73] Assignee: **Motorola, Inc.**, Franklin Park, Ill.

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[52] **U.S. Cl.** ..... **200/42 R**

[51] **Int. Cl.** **H01h 27/00**

[58] **Field of Search** ..... 200/42 R, 44, 45

[56] **References Cited**

UNITED STATES PATENTS

2,921,299	1/1960	Zimmerman	200/44
3,174,003	3/1965	Armstrong	200/44

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[57] **ABSTRACT**

A key operated switch is provided having a locking portion operative in response to insertion of a key to unlock and rotate. A nonconductive actuation cylinder is coupled to and rotates with the lock. This actuation cylinder has a conductive contact bar mounted therein, and has a key slot through the center. Circuit means are provided for connecting the actuation cylinder contact bar and external circuitry when the actuation cylinder is rotated. The key is provided having a first portion for insertion into the lock means for unlocking and rotating the same, and a second portion for insertion through the actuation cylinder key slot. The second portion is operative to inhibit portions of the circuit means from engaging the actuation cylinder contact bar.

13 Claims, 4 Drawing Figures

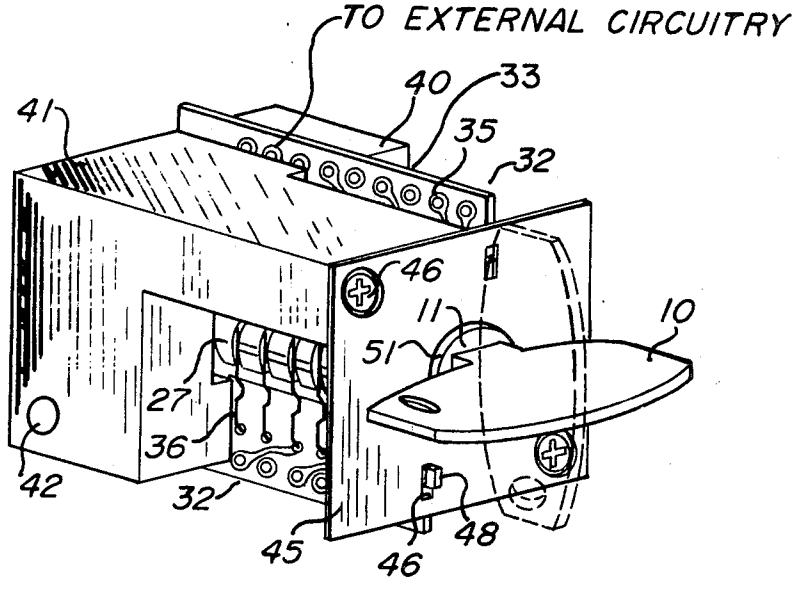

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Fig. 1

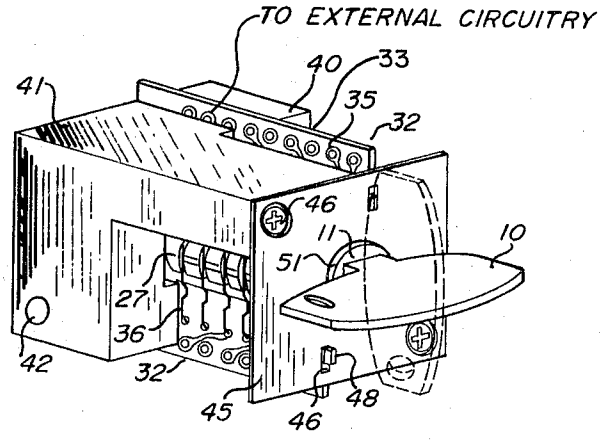

Fig. 3

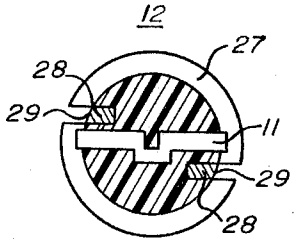

Fig. 4

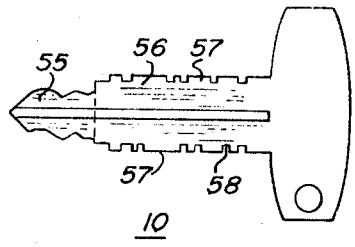

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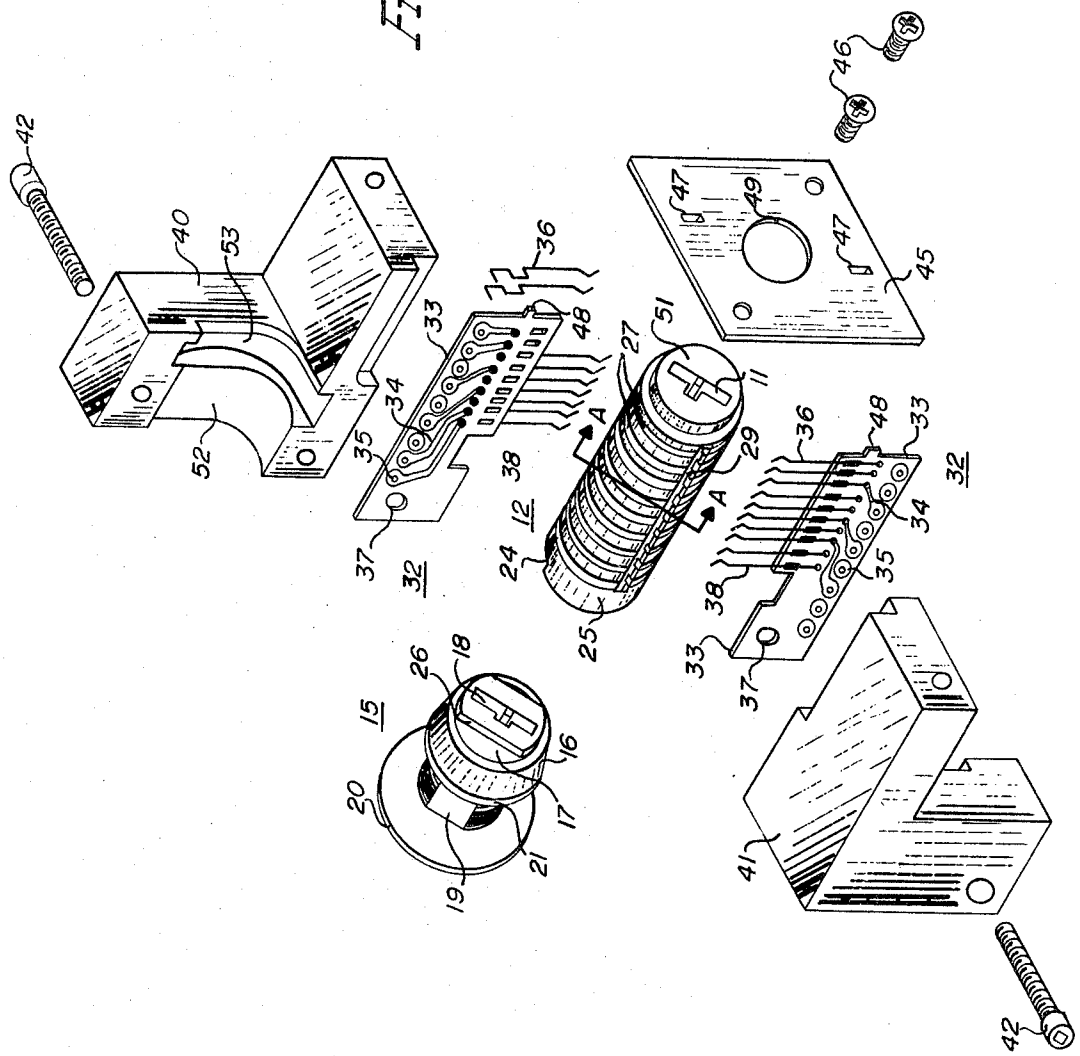
Fig. 2



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KEY OPERATED SWITCH

BACKGROUND

Certain types of communication systems, for example police vehicular status systems, and certain types of credit card recording systems, such as credit card sales of gasoline, require a remote unit to transmit the identification number of the user to a central location. The signal transmitted is usually a binary coded form of the decimal digit identification number. The remote unit must therefore be capable of accepting a device which has the user's number stored therein, and which programs the unit to send a signal representing the binary coded form of the decimal digit to a central location. One system previously employed used credit cards and credit card readers. The credit cards are easily bent out of shape and destroyed.

Another system uses a plug-in type printed circuit module and the associated circuitry for sending a signal representing the binary coded decimal digit. The plug-in module is cumbersome to carry and easily damaged. A third system employs a key and a switch, activated by insertion of the key. Such systems can easily be operated by an improper key.

SUMMARY

It is an object of this invention to provide a key operated switch.

Another object of this invention is to provide a key operated switch which cannot be activated until unlocked by the correct key.

Yet another object of this invention is to provide a key operated switch wherein each use wipes the switch contacts.

Still another object of this invention is to provide a key operated switch which must be unlocked and rotated in a predetermined arc before the switch contacts are activated.

In practicing this invention a key operated switch is provided which has a locking portion operative in response to insertion of a key to unlock and rotate. A nonconductive actuation cylinder is coupled to and rotates with the lock. The actuation cylinder has a conductive contact bar mounted therein and a key slot through the center. Guide channels are cut in the cylindrical surface perpendicular to the axis of the cylinder. Circuit boards are provided having resilient conductive springs mounted thereon. The springs are positioned in the guide channels of the actuation cylinder and contact the actuation cylinder contact bar when the cylinder is rotated. One of the springs can have an operating potential coupled thereto from the external circuitry. This potential is coupled through the contact bar to the other conductive springs and then to the external circuitry.

A key is provided which has a first portion for insertion into the locking device for unlocking and rotating the same. A second portion of the key is inserted through the actuation cylinder key slot. This second portion has an edge which extends into the guide channels. The edge has notches cut therein which align with certain of the guide channels when the key is properly inserted. The notches are cut in accordance with the desired binary coded decimal digit or number to be transmitted. If a notch is cut in the key to correspond to a particular guide channel, the resilient springs will be allowed to contact the actuation cylinder contact bar allowing a potential to be coupled through the spring to the external circuitry. If there is no notch cut in the key edge, the resilient conductive spring will be lifted by the key edge extending into that guide channel, and contact with the actuation cylinder contact bar will be inhibited. The absence of a potential coupled to the external circuitry by the spring represents a binary one. The presence of a potential represents a binary zero.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the key operated switch with the key inserted and shown in the two positions;

FIG. 2 is an exploded perspective view of the key operated switch of FIG. 1;

FIG. 3 is a section view of the actuation cylinder shown in FIG. 2, along the section lines indicated as AA;

FIG. 4 is a plan view of a key used in the key operated switch.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the key operated switch is shown with key **10** inserted into key slot **11** of actuation cylinder **12**. The dotted lines show key **10** in its alternate, unlocked, position. FIG. 1 shows the parts of the switch described below, in assembled relation.

Referring to FIG. 2, the exploded perspective view of the switch allows all of the component parts to be seen. Lock **15** includes a first portion **16**, known as a lock housing, and a second portion **17**, positioned within the first portion, known as a lock cylinder. A locking mechanism, located within lock cylinder **17**, locks cylinder **17** and housing **16** together. Housing **16** and cylinder **17** are unlocked and allowed to rotate with respect to one another by inserting the correct key, such as key **10**, into slot **18** of lock cylinder **17**. In the embodiment shown, lock housing **16** and lock cylinder **17** can rotate 90° with respect to one another. Lock housing **16** has a flat portion **19** which, when the switch is assembled, acts as a key to prevent lock housing **16** from rotating along with lock cylinder **17**. A shoulder **21** on lock housing **16** prevents lock **15** from being pulled backward out of its housing when assembled. A washer **20**, secured to the rear surface of lock cylinder **17**, rotates with lock cylinder **17**. Washer **20** prevents lock **15** from being pulled forward out of its mounting, just as shoulder **21** of lock housing **16** prevents lock **15** from being pulled backward out of its housing.

A nonconductive actuation cylinder **12**, is positioned against lock **15**. When in assembled relation, end **25** of cylinder **12** has a depression **24** which accepts the raised end **26** of lock cylinder **17** on lock **15**. Actuation cylinder **12** has a key slot **11** which extends through the center, along the axis. With a key, such as key **10** shown in FIG. **4**, inserted through cylinder **12** into lock **15**, lock cylinder **17** of lock **15** will unlock allowing lock cylinder **17** and cylinder **12** to rotate together in a 90° arc.

Actuation cylinder **12** has guide channels **27** cut into the cylindrical surface. Referring to FIG. **3** there is shown a section view of cylinder **12** taken along the section lines AA in FIG. **2**. Conductive contact bars **28** are embedded into cylinder **12**, and positioned parallel with the axis of cylinder **12**. Conductive contact bars **28** have a surface **29** which extends into guide channels **27**. Key slot **11** of actuation cylinder **12** also extends into the guide channels adjacent contact bars **28**.

Circuit means **32** are provided for connecting the switch to the externally operated circuitry. Circuit means **32** includes a printed circuit board **33** having printed circuitry **34** thereon. Terminals **35** secured to printed circuitry **34** are used for connecting the switch with the desired externally operated circuitry. Resilient conductive springs **36** are mounted on printed circuit boards **33**, and coupled to printed circuitry **34**. When circuit means **32** are assembled into the switch, resilient conductive springs **36** are positioned in guide channels **27** of actuation cylinder **12**. Guide channels **27** maintain springs **36** in their proper position, preventing the springs from touching or interferring with one another.

A housing for holding lock **15**, actuation cylinder **12** and circuit means **32** in assembled relation consists of first and second housing sections **40** and **41**. Sections **40** and **41** are made identical to one another in order to reduce construction costs and ease the manufacturing process. The sections are positioned upside down with respect to one another, and attached to one another by screws **42**. Circuit means **32** each have a portion sandwiched between sections **40** and **41** with screws **42** passing through openings **37** to hold the rearward portions of circuit means **32** in assembled relation. Flat portion **19** of lock cylinder **16** keys with flat portion **52** of housings **40** and **41** to prevent rotation. Shoulder **21** seats in recess

53 of housing portions 40 and 41 to prevent lock 15 from being pulled out of the housing.

Front retainer plate 45 is secured to the ends of housing sections 40 and 41 by screws 46. Slots 47 in plate 45 accept tabs 48 of printed circuit board 33, retaining the front end of printed circuit boards 33, and therefore circuit means 32, in proper alignment. Opening 49 in plate 45 allows the raised portion at end 51 of actuation cylinder 12 to extend therethrough, and retains the remaining portion of actuation cylinder 12 in assembled relation between housing sections 40 and 41, and against lock 15.

Key 10, shown in FIG. 4, includes a first and second section, 55 and 56 respectively, shown separated by dashed lines. The first section inserts into and unlocks lock 15. The second section inserts into actuation cylinder 12. Edges 57 of key 10 extend into guide channels 27 of actuation cylinder 12. Notches 58 are cut into edges 57 of second section 56 in accordance with the desired binary coded decimal digit which is to be transmitted to the externally operated circuitry.

In operation, section 55 of key 10 is inserted through actuation cylinder 12 into lock 15, unlocking the lock housing 16 and lock cylinder 17. The key is rotated 90° as shown in FIG. 1 to its fully unlocked position. As key 10 is rotated, edges 57 of second section 56 on key 10, bear against resilient conductive springs 36 on circuit means 32, prohibiting contact with surface 29 of conductive contact bar 28 in cylinder 12. Where notches 58 have been cut into second section 56 of key 10, the resilient spring contacts 36 which align with these notches will be allowed to contact conductive contact bar 28. A main contact 38 provides a ground or other reference potential which is conducted through contact bar 28 to the contacted springs 36. This potential is coupled through printed circuitry 34 to terminals 35 of circuit means 32. From terminals 35 the potential is coupled to the externally controlled circuitry where it may be used to represent a binary zero. The resilient conductive springs 36 which are not in contact with conductive contact bar 28 will represent the other binary value.

Requiring full rotation of cylinder 12 before actuation of the externally operated circuitry causes resilient conductive springs 36 to be wiped or slid across top surface 29 of conductive contact bar 28 with each usage. This prevents oxidation of the conductive springs and contact bar which could cause the switch to malfunction. The full rotation of the lock and cylinder before actuation of the external circuitry prevents accidental operation of the switch by insertion of a wrongly coded key.

As can be seen, a key operated switch has been provided which cannot be activated until unlocked by the correct key. Activation of the circuitry will not occur until the rotating portion of the lock and the actuation cylinder have been rotated in the full predetermined arc. Rotation in the full predetermined arc causes the switch contacts to be wiped by the contact bar thus preventing oxidation which could lead to improper operation.

I claim:

1. A key operated switch including in combination; lock means having a first and second portion, said lock means operative in response to insertion of a key to unlock and allow rotation of said first portion with respect to said second portion, an actuation cylinder coupled to said lock means and rotatable therewith, said actuation cylinder including contact means therein, and having a key slot therethrough, circuit means for providing electrical contact with external circuitry, said circuit means being coupled to said actuation cylinder and engaging said actuation cylinder contact means when said lock means first portion is rotated and, a key having a first portion for insertion into said lock means for unlocking and rotating same, and a second portion for insertion through said actuation cylinder key slot, said second portion operative to inhibit portions of said circuit means from engaging said actuation cylinder contact means.

2. The key operated switch of claim 1 further including housing means adapted to support said lock means, said actuation cylinder, and said circuit means.

3. The key operated switch of claim 2 wherein said circuit means includes circuit board means for providing electrical contact with said external circuitry, and a plurality of resilient conductive means mounted to said circuit board means for making electrical contact with said actuation cylinder contact means.

4. The key operated switch of claim 3 wherein said actuation cylinder is electrically nonconductive and said contact means is conductive said actuation cylinder including a plurality of guide channels in the cylindrical surface, parallel to the cylinder axis, for guiding said resilient conductive means, said contact means having portions extending into said guide channels for contacting said resilient conductive means, said actuation cylinder key slot extending into said guide channels, said key when inserted through said actuation cylinder key slot having portions extending into a plurality of said guide channels, for bearing against the resilient conductive means in said guide channels when rotated to inhibit contact with said contact means.

5. The key operated switch of claim 4 wherein said key includes; a first portion having notches cut therein for actuating said lock means, and a second portion having notches cut therein at predetermined locations for allowing contact between a predetermined number of said resilient conductive means and said contact means, said second portion inhibiting contact between the remainder of said resilient conductive means and said contact means.

6. The key operated switch of claim 5 wherein said circuit means includes a plurality of circuit boards each having a plurality of resilient conductive means mounted thereto said resilient conductive means being formed from spring wire.

7. The key operated switch of claim 6 wherein said contact means in said actuation cylinder is a contact bar, extending parallel to the axis of said actuation cylinder and perpendicular to said guide channels, said contact bar having a portion extending into said guide channels for contacting said resilient conductive means.

8. The key operated switch of claim 7 wherein said plurality of circuit boards is two circuit boards.

9. The key operated switch of claim 8 wherein said housing includes first and second identical sections and a retaining plate, said identical sections being coupled together, and said retaining plate being secured to said sections at one end thereof for retaining said lock means, circuit means, and actuation cylinder in assembled relation.

10. A key operated switch including in combination; lock means operative in response to insertion of a key to unlock and allow rotation thereof in a predetermined arc to a first position, contact means coupled to said lock means and rotating therewith, circuit means for providing electrical contact with external circuitry, said circuit means including resilient conductive means coupled to said contact means when said lock is rotated to said first position and, a key having a first portion for insertion into said lock means for unlocking and rotating same, and a second portion in operative association with said resilient conductive means to inhibit particular of said resilient conductive means from engaging said contact means when said lock is in said first position.

11. The key operated switch of claim 10 further including a housing means adapted to support said lock means, said contact means, and said circuit means.

12. The key operated switch of claim 10 wherein said contact means is an electrically nonconductive actuation cylinder having a plurality of guide channels in the cylindrical surface thereof for guiding said resilient conductive means, said guide channels being parallel to one another and perpendicular to the cylinder axis, an electrically conductive contact bar mounted in said cylinder parallel to said cylinder axis, said contact bar having a first surface extending into said guide channels for contacting said resilient conductive means when said lock is rotated to said first position, and a key slot for accepting said key second portion, said key slot extending parallel to said cylinder axis and having a portion extending into said guide channels.

13. The key operated switch of claim 12 wherein said circuit means includes a plurality of circuit boards each having a plurality of resilient conductive means mounted thereto, said resilient conductive means being formed from spring wire.

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