United States Patent

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[72] Inventor **Hermann Plieninger**
Neugilching, Germany

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[73] Assignee **Siemens Aktiengesellschaft**
Berlin and Munich, Germany
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[33] **Germany**
[31] **S 113043**

[54] **KEY FOR A KEYBOARD WHICH MAY BE MADE MORE OR LESS DIFFICULT TO DEPRESS**
2 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **197/107,** 197/98
[51] **Int. Cl.** **B41j 5/22**
[50] **Field of Search** 197/98, 102, 103, 104, 107, 108, 110

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Primary Examiner—Ernest T. Wright, Jr.
Attorney—Hill, Sherman, Meroni, Gross & Simpson

ABSTRACT: A key for a keyboard such as is used in control stations for computers, teletypewriters, and other machines, in which keys are used to transmit or record intelligence, and which may have one or more selected keys that may be rendered difficult to press, which pressure is substantially more than the normal operating pressure of the keys. Each key is operatively associated with a magnetizable disc and a permanent magnet and an electromagnet which provide the biasing force so as to block the key. The key is also spring-biased so that it may initially be pressed for a first distance.

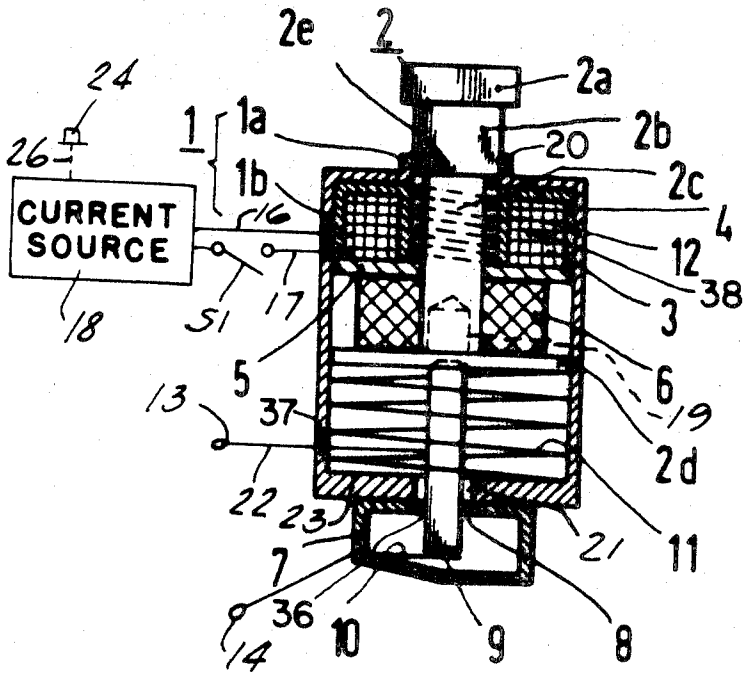


Fig. 1

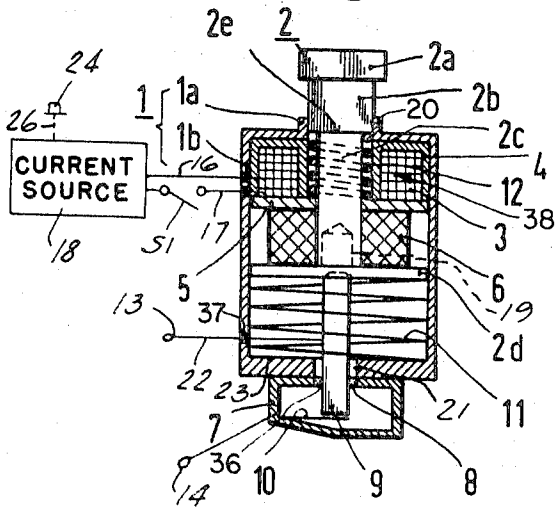


Fig. 2

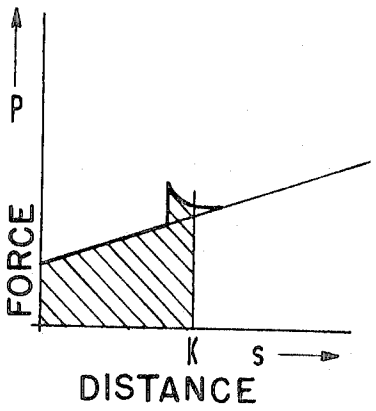


Fig. 3

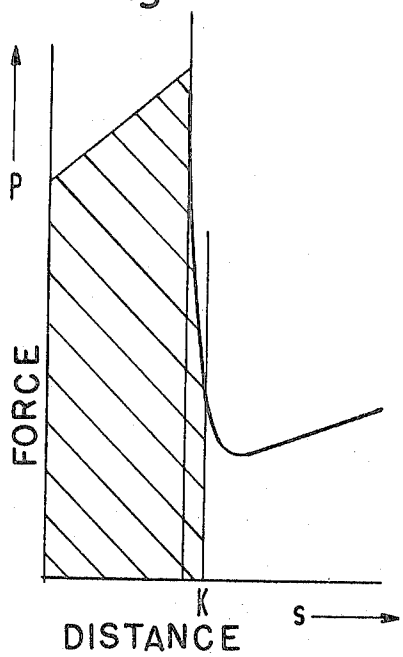
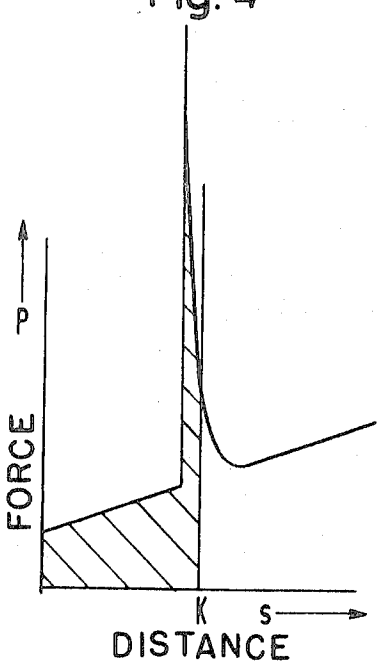


Fig. 4



INVENTOR
HERMANN PLIENINGER

BY Hill, Sherman, Meroni, Gross & Simpson
ATTORNEYS

KEY FOR A KEYBOARD WHICH MAY BE MADE MORE OR LESS DIFFICULT TO DEPRESS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to keyboards and in particular to a keyboard having keys that may be selectively depressed to record or transmit intelligence such as used in typewriters, teletypewriters, feeder machines for computers, control panels for keypunch equipment and other similar applications.

2. Description of the Prior Art

It is at times desirable and necessary to block certain keys on a keyboard so that particular keys cannot be energized or which will be energized under conditions where the operator knows that he is actuating a key that is heavier biased than usual. Prior blocking means for keys have consisted of mechanical locks which engage the keys to prevent the selected keys from being depressed.

SUMMARY OF THE INVENTION

The present invention relates to a means and apparatus for selectively blocking certain keys on a keyboard in which the key may be depressed for a first portion of its travel before encountering a strong blocking force. A substantial amount of force may be utilized to overcome the blocking force if desired by the operator to actuate the key.

The key is operatively associated with a magnetizable disk and a permanent magnet and an electromagnet which provides a biasing force so as to block the key. The key also is spring biased so that it may be initially depressed for a first distance and which engages a substantial resisting force after the spring has been depressed that can only be overcome by substantial force on the key when the electromagnet is activated. A further depression of the key moves a permanent magnet about a magnetizable pin that energizes a switch to actuate an external circuit in response to the depression of the key.

When the key is released the biasing springs return it to the up position and the magnetizable pin allows the controlled contacts to open and the key to return to its initial position.

Other and further objects of the invention will become apparent to those skilled in the art from the following detailed description of the single sheet of drawing which shows the preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of a key according to this invention;

FIG. 2 is a graph of force versus distance plot for the key of FIG. 1 when it is unblocked without a biasing spring;

FIG. 3 is a force versus distance plot of the key when it is blocked; and

FIG. 4 is a force versus distance plot of the key of FIG. 1 for a structure which does not have biasing springs.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 illustrates a key according to this invention wherein a housing 1 has a generally cylindrical outer portion 1*b* and an opening 20 formed in one end with a neck 1*a* in which a key 2 is inserted. The key 2 has a flanged operating portion 2*a* which is connected to a cylindrical neck portion 2*b* of nonmagnetic material and which has a diameter of a size such that it fits within the opening 20 of the portion 1*a*. A lower extending portion 2*c* of smaller diameter extends from the portion 2*b* and is attached to a disk member 2*d* that has an outer diameter equal to the inner diameter of the housing portion 1*b*. The disk 2*d* and the lower portion of the portion 2*c* is formed with an opening 19 into which the end of a magnetizable pin 9 may be received. The pin 9 extends through an opening 21 in the lower portion of the housing portion 1*b* and into a sealed switching chamber formed by the conducting housing 7. The housing 7 has an opening 36 in which a glass seal 8 surrounds the pin 9. The lower end of the pin 9 is mounted adjacent an electrical contact 10 which has its other end connected to the conducting housing 7. An input terminal 14 is electrically connected to the conducting housing 7 to form one terminal of an electrical output circuit. The pin 9 is insulated by glass seal 8 from the housing portion 7 and the housing portion 1*b* and a conductor 22 extends through an insulated opening 37 in the wall of the housing 1*b* and is connected to a second output terminal 13. Thus, when the flexible contact 10 engages the pin 9 the electrical circuit is closed between the contacts 13 and 14. The flexible contact 10 does not engage the pin 9 unless the key 2 is depressed but the contact 10 is flexible and can be drawn by magnetic force to engage the end of pin 9 when the key 2 is depressed.

A spring 11 is mounted between the end wall 23 of the housing portion 1*b* and the disk 2*d*.

A toroid formed permanent magnet 6 is mounted about the portion 2*c* between the disk 2*d* and a second disk 5. A spiral spring 12 is mounted between the disk 5 and the lower portion 2*e* of the neck portion 2*b* of the key 2. An electromagnet 38 is mounted in the housing portion 1*b* between the portion 1*a* and the disk 5 and comprises a core form 4 that is opened on the portion facing the disk 5 and a winding 3 is wound tin the core form 4. Leads 16 and 17 extend from the winding 3 and are insulated from the housing portion 1*b*. A switch S1 is mounted in the line 17 and a current source 18 is connected to the switch S1 and the lead 17. A knob 24 is connected to a shaft 26 for adjusting the current in the winding 3 when the switch S1 is closed.

The flange 2*a* and neck portion 2*b* are non magnetic. The pin 9 is of magnetizable material and is electrically conductive so as to conduct current when the switch contact 10 engages it. The toroid magnet 6 is formed of permanent magnetic material and is magnetized radially.

In operation, if the switch S1 is open so that the key 2 is not blocked or partly blocked, movement of the key 2 is substantially a linear function of the spring 12 until the lower portion of the member 2*c* and the magnet 6 are forced to pass over the upper end of the pin 9 thus causing the magnetic flux of the permanent magnet 6 to attract the contact 10 to the magnetizable pin 9 and thus close the circuit between the contacts 13 and 14.

If the switch S1 is closed the electromagnetic force formed by the winding 3 will hold the permanent magnet 6 against the disk 5 and the disk 5 against the core form 4 as the key 2 is depressed. Thus the key portion 2*e* will depress and compress spring 12 until it has been completely depressed. When electromagnet 38 is not energized the spring 12 does not have an effect because no relative movement occurs between the key 2, spring 12, adherence disk 5 and permanent magnet 6. The key 2 can be pressed downwardly against the force of the recoil spring 11. Thus, the permanent magnet 6 moves down over pin 9 causing more and more magnetic flux to flow through pin 9 and this concentration of flux causes flexible switch contact 10 to move to engage the pin 9 closing the circuit between contacts 13 and 14. When the key flange portion 2*a* is released, the key 2 and also the permanent magnet 6 is moved to its initial position by the recoil spring 11 and flexible switch contact 10 moves out of engagement with pin 9.

With a blocked key 2, the electromagnet 38 is energized and the pressure spring 12 is supported by the adherence disk 5 which adheres to the core form 4 of the electromagnet 38. If now the key 2 is pressed further, the force of the recoil spring 11 and the force of the spring 12 must be overcome. The spring 12 is suitably pretensioned so that it produces a force slightly below the holding force of the adherence disk 5 with electromagnet 38 and, as seen in FIG. 3, the hatched area becomes as large as possible below the power curve of FIG. 3. The pressure spring 12 does not change the blockage force, rather it is determined by the holding force of the adherence disk 5 with the electromagnet 38. The blockage energy, however, causes an increased key force which is effective over a

larger key distance. A comparison of FIGS. 2 and 3 which illustrate a force-distance diagram for an unblocked key 2 without spring 12, and a diagram for a blocked key 2 with spring 12, respectively, shows that not only the blockage force but, in particular, the blockage energy (force times distance) is essentially higher with blocked keys 2. If the spring 12 were omitted, mere blockage energy would result until the point that contact is made (K). This blockage energy is illustrated in FIG. 4 by hatching. This condition is illustrated in FIG. 3 and it is to be particularly noted that much greater force is required to depress the key 2 when the switch S1 is closed than is required when the switch S1 is open, for example, the force illustrated in FIG. 3 is substantially more than the force illustrated in FIG. 2.

If the spring 12 were eliminated only the blocking energy from the electromagnet 38 would exist.

The knob 24 and shaft 26 allows the current source 18 to be adjusted to adjust the amount of current in the winding 3. With the key 2 in the position shown in FIG. 1 only a small amount of magnetic flux flows through the pin 9 and this is insufficient to cause the contact 10 to engage the pin 9. When the key 2 is pressed downwardly against the force of the recoil spring 11 and the spiral spring 12 the holding magnetic force from the electromagnet 38 will be felt. If the key 2 is depressed further the completely compressed spring 12 causes the adherence disk 5 and magnet 6 to release from the electromagnetic core form 4 and the magnet 6 will move close to the flux guide pin 9 thus causing the flux in the pin 9 to increase to attract the flexible contact 10 and complete the circuit between contacts 13 and 14.

The recoil spring 11 and spring 12 will return the key 2 and the magnet 6 to the position shown in FIG. 1 when the key 2 is released.

Since the holding force of the permanent magnet 6 is a function of the size of the adherence surface and the amount of magnetization of the magnet 6, the key pressure may be varied by correspondingly varying these two factors thereby effecting the switching operation of the contact 10. The blocking force can also be controlled by the adjustment of the current source 18 through the knob 24.

The operator becomes accustomed to the unblocked tension on the keys 2. When it is desired to inhibit or block certain the keys 2 the switch S1 is closed and the operator immediately is aware of the increase force on the blocked keys 2. The keys 2 may still be depressed by exerting approximately four times the normal closing force as shown by comparing FIG. 2 and FIG. 3 but the keys 2 would be depressed when blocked only when this is particularly desired by the operator and the operator would realize that he was depressing a blocked key 2.

The disks 5 and 2*d* and toroid magnet 6 are loosely mounted in the housing 1. The electromagnet 38 comprising coil 3 and core form 4 are fixed to the housing 1.

FIGS. 2, 3 and 4 are force versus displacement plots. The force "P" is the force required to move the key 2. The distance "S" is the displacement of the key 2. "K" indicates the displacement at which the flexible contact 10 engages pin 9 to complete the electrical circuit between contacts 13 and 14.

The switch S1 may be actuated manually or automatically.

It is seen that this invention provides a simple and inexpensive apparatus for selectively blocking keys of a keyboard.

Although I have herein set forth my invention with respect to certain specific principles and details thereof, it will be understood that these may be varied without departing from the spirit and scope of the invention as set forth in the hereunto appended claims.

I claim as my invention:

1. A key for a keyboard for actuating a signal means comprising a housing, a key supported for longitudinal movement in said housing and having a first portion which extends from said housing; an electromagnet fixed to said housing at one end thereof and said key extending through said electromagnet; and adherence disk loosely mounted in said housing adjacent said electromagnet and formed with a central opening through which said key extends; a toroid-shaped permanent magnet loosely mounted in said housing adjacent said adherence disk and said key extending through said permanent magnet; a second disk loosely mounted in said housing adjacent said permanent magnet and attached to an end of said key, said end of said key formed with an opening; a magnetizable member fixed to said housing and mounted such that when said key is in an undepressed position said magnetizable member is not in said opening formed in the end of said key and when said key is in a depressed position said magnetizable member is within said opening formed in the end of said key; a magnetic-responsive switch contact attached to said housing and engageable with said magnetizable member when said key is in the depressed position; means for energizing said electromagnet, a first spring disposed in said housing between said adherence disk and said one end of said housing and engageable with said key to bias said key to the undepressed position when said electromagnet is energized and mounted for movement with said adherence disk when said electromagnet is not energized, and including a second spring mounted in said housing between said second disk and said housing to bias said key to the undepressed position.

2. A key for a keyboard according to claim 1 wherein said housing is electrically conductive and said magnetizable member is electrically insulated from said housing, and a pair of electrical conductors connected respectively to said housing and said magnetizable member.

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