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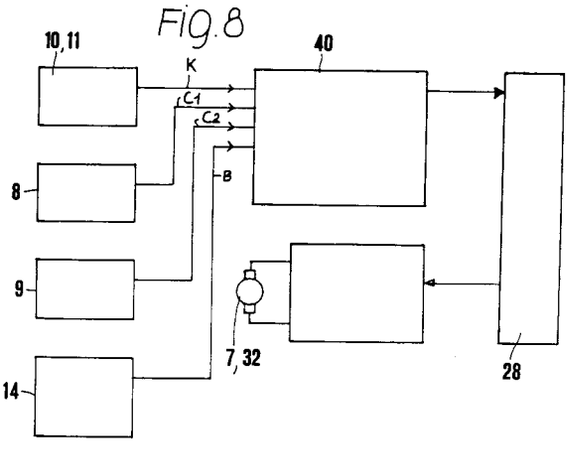
(54) Remote monitoring device for safety doors and the like.

(57) Remote monitoring device for safety doors and the like equipped with a lock, comprising an electronic control computer (28), a plurality of sensors (8,9,10,11) located in preset positions on each safety door, interface conversion means (40) located between the sensors and the computer and locking or interference means (7,32) for each safety door, which can be driven by the computer (28).

Fig.8



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The present invention relates to a remote monitoring device for safety doors for safekeeping means, vaults and the like.

The aim of the present invention is to provide a device which can remotely monitor all the functions of actuation and management of the moving parts in a safety door, i.e. the rabbet, the lock or locks, the bolts, etc.

A further object of the present invention is to provide a device which is easy to apply and manage and has a high degree of reliability.

This aim, this object and others which will become apparent hereinafter are achieved, according to the present invention, by a remote monitoring device for safety doors and the like, which comprises an electronic control computer, a plurality of sensors located in preset positions on the safety door, interface conversion means located between the sensors and the computer, and locking means driven by the computer.

Further aspects and advantages of the present invention will become apparent from the following detailed description of some preferred but not exclusive embodiments thereof, illustrated only by way of non-limitative example with reference to the accompanying drawings, wherein:

figures 1 and 1A are views of a printed circuit arranged adjacent to a safety door lock;

figure 2 is an enlarged-scale front view of the printed circuit of figure 1;

figure 3 is a view, similar to the view of figure 2, of a printed circuit associated with a mechanical feeler;

figure 4 is a schematic view of a moving contact which controls a potentiometer;

figure 5 is a partial schematic view of a multi-pin bolt provided with a moving contact;

figures 6 and 7 are views of two further embodiments of the printed circuit mounted so as to be controlled by a lock; and

figure 8 is a block diagram of the connection of various sensors for monitoring a safety door, connected to a remote centralized processing unit.

In the various figures, identical or similar parts or components have been designated by the same reference numeral.

With reference to the above figures, the reference numeral 1 generally designates a mechanical lock which can be operated by means of a key (not shown) which can be inserted in an opening 2. The lock 1 is provided with a bolt 3 and with fixing holes 4 and can be seated in or onto a safety door (also not shown) for safekeeping means, such as safes in general, vaults and the like.

A printed circuit board 5 can be directly fixed to the lock 1, for example by means of three or more fixing screws -- not shown in the drawings -- which pass through holes 6. An electromechanical component, for example an electromagnet 7, capable of interfering with at least one movable element of the lock 1, such as a plate, four sensors 8, 9, 10 and 11 arranged in appropriate positions and two connectors 12 and 13 are provided on the board 5. The sensors 8 and 9 are suitable to detect the position of a respective bolt 3 of the lock (assumed to be provided with two bolts), whereas the sensors 10 and 11 are meant to detect the presence and position of the key in the keyhole of the lock, which is located at a shaped opening 15 of the board 5 (see also figure 8). The sensors 8 to 11 may be of any suitable type, such as infrared sensors or magnetically-acting sensors, capable of detecting the states of certain mechanical elements of the lock 1 and/or of other movable elements, such as keys, bolts, rabbet, feelers and the like. The connector 12 is meant to establish an electrical connection with a remote sensor, typically a sliding-contact resistive sensor or potentiometer 14, as will be explained hereinafter, whereas the connector 13 is meant for connection to an electronic control computer.

Figure 3 illustrates a printed circuit 5 provided with a potentiometer 14, with which a rod or mechanical feeler 16 can interact; said rod or feeler 16 can be loaded by a return spring 17 and is mounted so that it can slide with respect to the potentiometer 14 but so that it is rigidly associated in motion with the bolt 3, for example by means of a linkage bracket 18 fixed to the bolt.

The potentiometer 14 can be of the type with a moving contact which moves either along a straight path or along a path which curves about an axis, but is in any case suitable to transduce the position of the feeler 16 with respect to a jamb 19 against which the lock 1, and thus the door on which it is installed, is to be closed. The jamb 19 in turn can have an accommodation and engagement seat 20, for the end of the bolt 3 which protrudes from the lock, having a plurality of depth levels 21 and 22 (preferably specific for each safety door, i.e. non-repetitive): one for the bolt and the other for the feeler.

The feeler 16 can be partially rigidly associated in motion either with the bolt 3, as in figure 3, or with the expansion elements (bolt plates) 23 of the bolt or bolts, as shown in figure 5.

In the embodiment of figures 4 and 5, the rod or feeler 16 is supported in a cantilevered manner by the bolt plate 23 or by a bolt plate locking expansion 24 and is slideable with respect to a potentiometer 14, which is fixed to the bolt plate, in contrast with a loading spring 17 which at one end abuts against an expansion 26 or a sleeve whose position can be adjusted and abuts against the potentiometer 14 at its other end. At its cantile-

vered end, the rod 16 supports a sliding roller 25 for the frictionless abutment against a seat 22 for accommodation in the jamb 19. The signals emitted by the potentiometer 14, as mentioned above, are transmitted, by means of a cable 27 connected to the connector 12, to an electronic control computer 28, as schematically shown in figure 8.

In the embodiment of figure 6, similarly to the one of figure 2, the lock requires no additional mechanical components except for one or more abutment protrusions 29 and one or more engagement recesses 30 to allow the locking and release of an engagement element 31 which can be actuated either by the electromagnet 7 or by a reversible electric motor 32.

The recess or recesses 30 can be defined on the bolt or on one or more plates which move rigidly with the bolt 3.

The actuation components 7 or 32 can be mounted on the electronic board 5, and engage bolt abutment elements or directly engage the bolt itself, as in figures 6 and 7.

Figure 7 is a view of a lock 1, in which an engagement element 31, actuatable by an electromagnet 7 or by a reversible electric motor 32, can engage in a recess 30 defined in a plate 33 provided for this purpose, slideable on fixed guides 34 transversely to the direction of motion of the bolt; said guides are provided with a tooth or abutment 35 which engages a shaped recess 36 with two positions provided in the bolt 3. The plate 33, when released by the engagement element 31, can be actuated by the key for opening and closing the lock in order to allow the forward or backward movement of the bolt.

Figure 8 illustrates the block diagram which shows the connections of the various electronic components controlled by the lock 1.

The signals which arrive from the various sensors, i.e. from the sensors 10 and 11 of the keyhole to indicate the presence or absence of the key for opening or closing the lock, from the sensors 8 for the first bolt, from the sensor 9 for the second bolt and from the sensor 14 for indicating the adjacent or non-adjacent position of the safety door with respect to the jamb 19, are sent along four separate inputs C1, C2, B and K to a digital-to-analog converter 40, with, for example, 16 output voltage levels, whose output is connected to the computer 28.

With this arrangement it is possible to have the following combinations of states. If the four inputs are all at level 1, this means that the rabbet of the safety door and the bolts are closed and that the key is in the keyhole; if inputs C1, C2 and B are at level 1 and input K is at level 0, this means that the bolts and the rabbet are closed and that the key is not inserted; if inputs C1, C2 and K are at level 1 and input B is at level 0, this means that the rabbet is open, the key is inserted and the bolts are closed; if inputs C1 and C2 are at level 1 and inputs B and K are at level 0, this means that the rabbet is open, the key is not inserted and the bolts are closed; if input C1 is at level 0, input C2 is at level 1 and inputs B and K are at level 1, this means that the rabbet is closed but that only the second bolt is closed and the key is inserted; if C1 and K are at level 0 and C2 and B are at level 1, this means that the rabbet is closed but that only the second bolt is closed and the key is not inserted; if C1 and B are at level 0 and C2 and K are at level 1, this means that the rabbet is open, that only the second bolt is closed and that the key is not inserted; if C1 and B are at level 0 and C2 and K are at level 1, this means that the rabbet is open, that only the second bolt is closed and that the key is inserted; if C2 is at level 1, whereas C1, B and K are at level 0, this means that the rabbet is open and the second bolt is closed; if C1, B and K are at level 1 and C2 is at level 0, this means that the rabbet is closed together with the first bolt and the key is inserted; if B and C1 are at level 1 and C2 and K are at level 0, this means that the rabbet and the first bolt are closed and that the key is not inserted; if C1 and K are at level 1 and B and C2 are at level 0, this means that the rabbet is open but that the first bolt is closed and the key is inserted; if B, C2 and K are at level 0 and C1 is at level 1, this means that the rabbet is open, the first bolt is closed and the key is not inserted; if C1 and C2 are at level 0 and B and K are at level 1, this means that the rabbet is in contact with the jamb but that no bolt is closed and the key is inserted; if C1, C2 and K are at level 0 and B is at level 1, this means that the rabbet is in contact with the jamb, the bolts are open and the key is not inserted; if B, C1 and C2 are at level 0 and K is at level 1, this means that the rabbet is open, the bolts are open and the key is inserted; finally, if all the inputs are at level 0, this means that the rabbet is open, the bolts are also open and the key is not inserted.

The computer 28, in a central control station, can thus intervene according to a program, in hazardous situations, on any one of a plurality of remote safety doors by emitting an output signal directed to an actuation element 7 or 32, locking or interfering with the lock and thus locking the rabbet in the closure position.

One or more display monitors for visual surveillance of the situation of the various remote safety doors may naturally be associated with the computer 28.

As can be seen, with the monitoring device according to the invention, the mechanical lock 1 acquires additional functions which combine synergetically with the original ones. However, the spe-

cific capabilities of the lock remain unchanged if the monitoring device is removed, in which case the lock can operate with a normal key-based manual actuation.

The invention as described above is susceptible to numerous modifications and variations within the protective scope defined by the content of the following claims.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Remote monitoring device for safety doors and the like provided with a lock (1), characterized in that it comprises an electronic control computer (28), a plurality of sensors (8,9,10,11) located in preset positions on each safety door, interface conversion means (40) located between the sensors (8,9,10,11) and the computer (28) and locking or interference means (7,32) for each safety door which can be driven by the computer.

2. Monitoring device according to claim 1, characterized in that it comprises a printed circuit (5) which comprises said plurality of sensors (8,9,10,11), said interface conversion means (40) and said locking means (7,32) and can be applied adjacent to a mechanical lock in the safety door.

3. Device according to claim 2, characterized in that at least one sensor (8,9) is assigned to detecting the position of the or of a respective bolt (3) or pin of the lock (1) and that at least one sensor (10,11) is meant to detect the presence of a key in the lock.

4. Device according to claim 3, characterized in that said locking means comprise at least one movable interference element (31) for the bolt or bolts of the lock, which can be actuated by an electric actuator (7,32).

5. Device according to any one of the preceding claims, characterized in that it comprises a feeler (16) supported by the safety door and controlled by a detection means (14) with a moving contact which is connected to the conversion means (40) to detect the adjacent position of the safety door with respect to an abutment jamb (19).

6. Device according to claim 5, characterized in that said feeler comprises an elastically loadable rod (16) which is rigidly associated in motion with the, or with a respective, bolt (3) of the lock.

7. Device according to claim 5 or 6, characterized in that said detection means is a moving-contact resistive element (14).

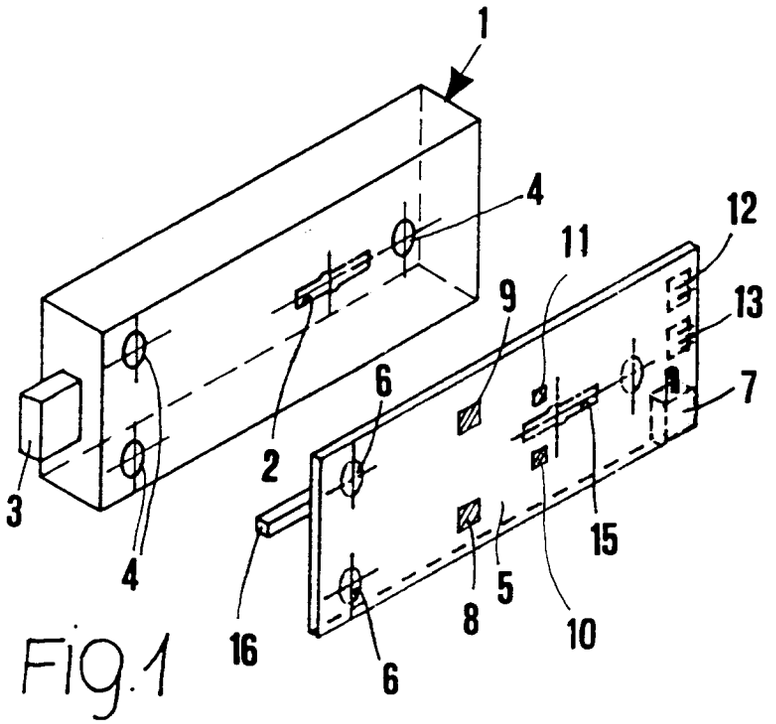


Fig.1

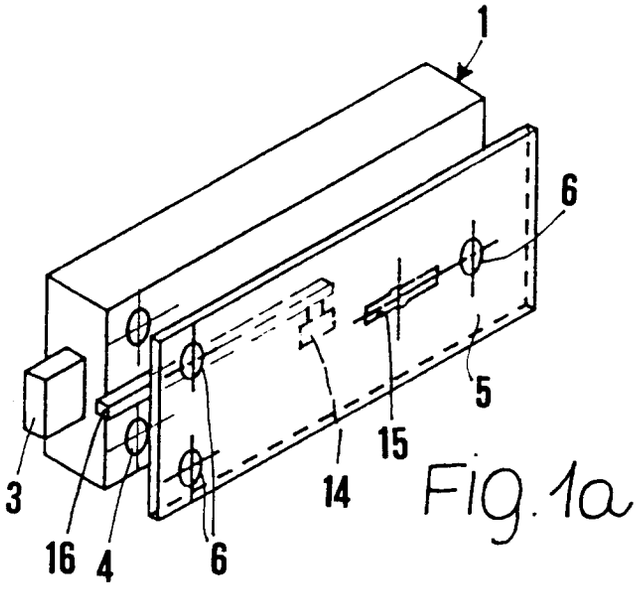


Fig.1a

Fig.2

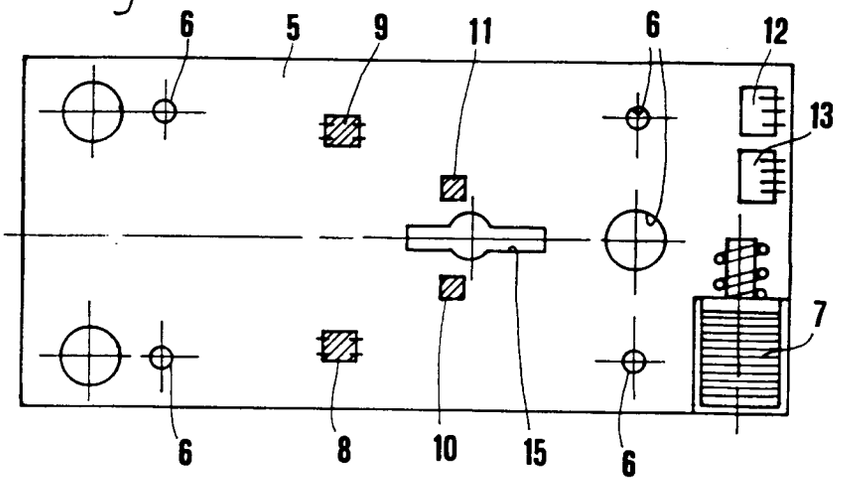
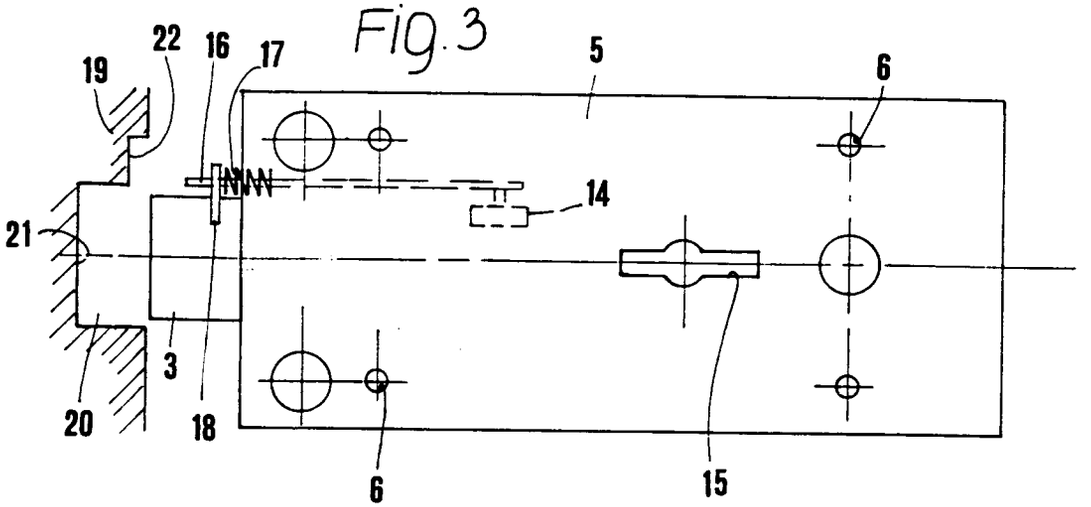


Fig.3



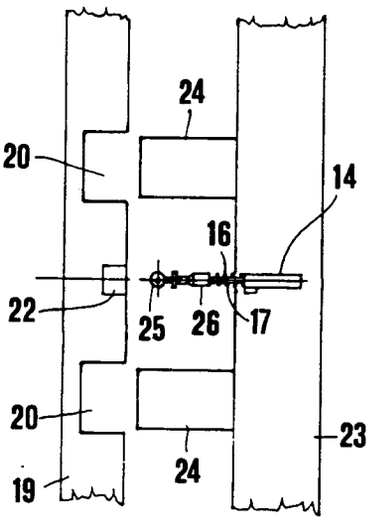


Fig.5

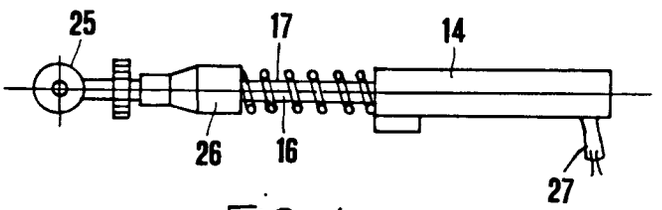


Fig.4

Fig.8

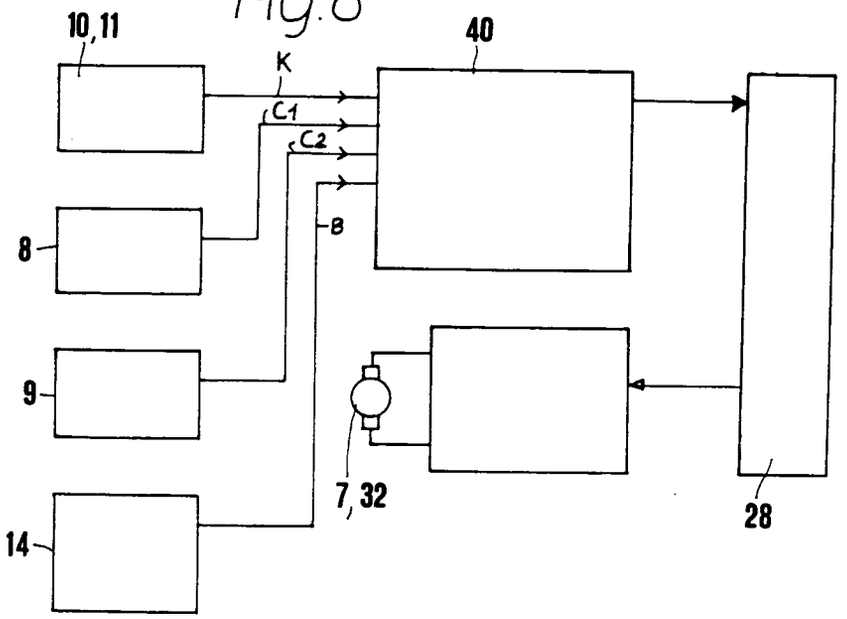


Fig.6

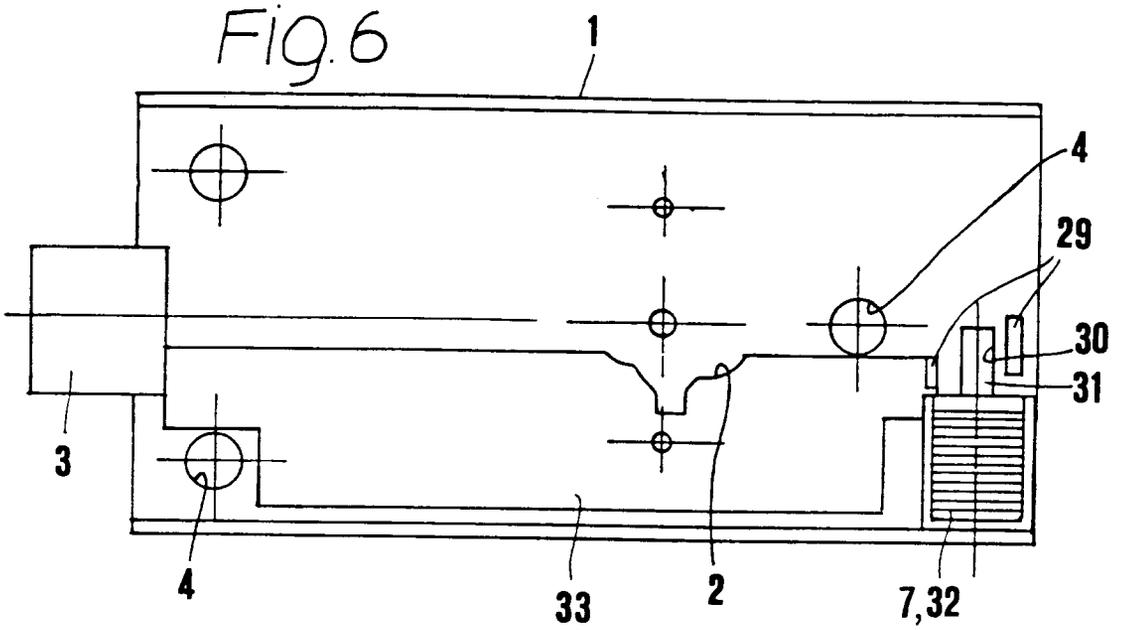


Fig.7