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(54) **Code type lock especially for safes.**

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Description

The invention relates to a code type lock comprising a key operated bolt and an electronic device capable of storing a code and permitting or preventing the opening of said bolt depending on the coincidence or non-coincidence of another code entered through a keyboard with the previously stored code.

An electronic combination door lock with dead bolt sensing means is known from U.S.—A—4,148,092. This discloses an electronic combination door lock which uses a push button keyboard and a door provided with a dead bolt manually operable by an outer turning knob. Electronic circuitry for the keyboard compares an input code with a stored code and generates an enabling signal only if the input code is the same as the stored code. The outer turning knob is restrained from being manually moved to retract the dead bolt when the door is in its locked condition. This restraining of the outer knob is removed by the enabling signal which requires very little energy so that the dead bolt can be manually retracted. Several different codes can be stored so that different persons can have access. The code can be reprogrammed or changed by means of the keyboard.

The lock of the invention is intended to be used in a safe and may present the particularity whereby each time said safe is opened the stored code is erased and the user, on leaving it closed, is able to set a new code, which may be identical to or different from the previously stored one.

By mere way of illustration, it is indicated that the uses of safes provided with this type of lock is extremely advantageous for hotel rooms, as on each occasion each guest will be able to apply a different code to the lock of the safe installed in his room and will thus obtain a high degree of security. With the system which has been developed it is further possible to make it unnecessary for users to carry the keys of their corresponding safes with them; hence, said users will not have to run the risk of losing them.

If an unauthorised person unfamiliar with the number of the code entered at the time in the safe wished to open it, he would attempt to do so by pressing keys to try his luck and endeavour to find the correct code with which said safe has to be opened.

The invention provides a means of dissuading said undue manipulations which consists in blocking the lock for a certain time, for example, half an hour, when the keyboard is unduly pressed. In addition, there are alarm means which are energized by the misuse.

The control system requires a direct current electric power supply, for which reason the safes will have to be connected to the mains through a current rectifying system.

According to the present invention there is provided a code type lock which comprises:

a lock means including a bolt and having a locking condition in which the bolt can engage with outside structure and an unlocking condition in which the bolt is disengaged from outside structure,

a direct current power source,

an electronic device for determining whether the lock means is in its locking or unlocking condition, said electronic device comprising a store, and input means for entering a master code into the store to be retained therein, comparison means for comparing the master code with an opening code subsequently entered through said input means and for providing a first output in the event that the opening code is identical to the master code and second output if the opening code is not identical to the master code, said electronic device keeping the lock means in its locking condition when said second output is provided and placing the lock means in its unlocking condition when said first output is provided to energise a solenoid associated with a shaft to release the bolt, characterised in that an erasing means is provided for erasing the master code upon each unlocking of the lock means, said electronic device further comprises counting means for registering the entry through said input means of an opening code which is not identical to the master code and disabling the operation of the lock for a predetermined time when the number of registered opening codes which are not identical to the master code reaches a predetermined number and to initiate an alarm, and a plurality of lamps for indicating the condition of the lock and the occurrence of at least a failure of the power supply.

The lock may also be provided with:

An emergency power supply system with a battery, which is energized in the event of a failure in the mains supply;

A suitably arranged system of lamps which will always show the state of the various components of the safe and, if pertinent, indicate the possibility of performing the necessary operations to open it;

A key which has to be inserted in the lock of the safe on commencing the service, which serves as an activator thereof and has a mechanical system which prevents its extraction when the pin of the lock is engaged.

To activate the control system, the key has at its forward end duly positioned conductor rings which, with their positioning, number, mutual separation and thickness, also make it possible to obtain a high number of combinations so that only one key may be used with a given safe.

To improve the function of this safe it is desirable to provide an arrangement which enables an authorized person to open the safe when it is closed and, therefore, have access to the mechanisms and other mechanical and electronic systems of the safe located in its rear part.

For this purpose, the present invention has developed an arrangement according to which, when the safe is closed, it is nevertheless possible to open it, in an emergency, with a special auxiliary key which shifts the entire lock unit backward, therefore releasing the anchoring systems which close its rear cover; thanks to this it is possible to attain access to the mechanisms and other mecanical and electronic systems of the safe.

However, in the case of normal operation the lock unit is only actuated by a striker with an electric motor 208 and solely in case of emergency is it actuated with the special auxiliary key.

The invention will now be described by way of reference to the accompanying drawings in which:—

Fig. 1 shows, in block diagram form, the operation of the electric circuits of the lock;

Fig. 2 schematically shows the key in its cooperation with a pin;

Fig. 3A shows the electromechanical combination of the system in the position in which the key is disengaged and the door open;

Fig. 3B shows a detail of the preceding figure depicting the position in which the key is blocked;

Fig. 4 shows a section along line IV—IV of Fig. 3A;

Figs. 5A and 5B are partially sectional side elevational views of the lock unit to show the inside thereof in its blocked position and in its shifted position, respectively;

Figs. 6A and 6B are front elevational and sectional views, respectively, along line VIB—VIB, of the rear cover with its anchoring system in the blocked position, the internal latches and pawls being shown in outline; and

Figs. 7A and 7B are front elevational and sectional views, respectively, along line VIIB—VIIB of said anchoring system of the rear cover in the released position, the internal latches and pawls being shown in outline.

To explain the operation of the safe, reference will be made firstly to the manner in which the code is entered in its lock. This code is entered after closing the door 209 of the safe, for which it will suffice to turn the pin P shown in Fig. 2. Referring now to Fig. 1, the key 102 is then inserted in the corresponding keyhole 2 of the lock; on reaching the correct stop, this key will activate an electronic device which detects its presence; this electronic device is formed by an optoelectronic detector 3 which starts a timer 4 and an electronic switch 5; the impulse passes through the flip-flop 13; the green lamp 10A will then turn on; this green lamp will remain lit until a predetermined period of time elapses, for example, 30 seconds.

If it is not desired to block the door of the safe with the code lock according to the invention, that is, if it is not desired to set any code in the main storage 39, the door can be closed with the key-operated bolt only, independently from the electronic circuit, and the green lamp will turn off after a predetermined period of time, for example, 30 seconds.

On the other hand, if it is desired to leave the safe closed with the code lock according to the invention, entering the master code which the user considers appropriate in the main storage device 39, after the key is inserted in the keyhole 2, the code in question, formed by a pre-established number of digits, is entered on the keyboard 1. Each digit is registered in said main storage device 39.

After the last of the three digits has been entered, the yellow lamp 10-B turns on, through the switch counter 40, which means that the code has been accepted.

If less digits than the pre-established number are entered, the impulses will be counted by the counter 40 which, on being connected with the yellow lamp 10-B, will make the latter turn on and flash for a predetermined time, for example, 4 seconds, thanks to the action of the timer 44, it then being possible to enter a new code. In this case, the inputs 42 and 48 serve to reset the main storage and the counter. The subsequent digits which might be pressed out on the keyboard would not be accepted.

The opening of the safe with a code already entered and stored in the code lock subject of the invention will be described below, again referring to Fig. 1.

When the user wishes to open said safe he firstly makes the key, inserted in the keyhole 2, reach the correct stop, activating the electronic device which detects its presence, through the above mentioned components 3, 4 and 5; the impulse passes through an oscillator 6 and a decoder 8 and turns on the yellow lamp 10-B.

When the yellow lamp 10-B turns on, this indicates that a code has already been registered in the main storage device 39 of the system and that there is a predetermined time available, for example 30 seconds, to enter the correct code through the keyboard 1, operated through the encoder 7. The impulses from the digits entered in the keyboard 1 will pass to the slave storage 29 and will be compared in the comparator 46 with the code contained in the main or master storage 39.

If the result of this operation is positive, that is, if there is coincidence, the comparator 46 will emit an impulse toward the flip-flop switch 13 which, in turn, will turn on the green lamp 10A. At the same time, the main storage 39 will be cleared or erased through the input 48.

When the green lamp 10A turns on in a continuous manner, this indicates that the lock can be opened by depressing the opening permission button in the keyboard 1 and that there is a predetermined time available for this action, for example, 4 seconds. The lock can then be opened. This predetermined period, for example, four seconds, is set through the timer 19.

When the green lamp 10A turns on and in a

flashing manner, this indicates that the voltage of the current supplied by the battery 25 sensed by the detector 24 is lower than a predetermined voltage, for example, 9 volts.

If an incorrect code is entered or no code at all is pressed out after the yellow lamp has turned on and the pre-established time, for example 30 seconds, has elapsed, this fact will be registered in a counter 28 of the slave storage and after another predetermined period passes, for example, 10 seconds, the yellow lamp 10B will commence flashing for a short period of time, set by the timer 34, for example, four seconds, thanks to the action of the warning unit 35; as soon as said lamp commences flashing, it will be possible to try to enter another code. A signal is simultaneously supplied from the counter 28 to the logic gate 32 to stop the timer 61 when a certain number of digits has been entered.

If three attempts have been made to press out incorrect codes and there is no coincidence between the code stored in the main storage 39 and the code or codes entered through the keyboard 1, the yellow lamp 10B will turn off and the red lamp 11 will turn on, thus indicating that the current supply 54 or 25 for the system has been cut off for a predetermined period of time, for example, half an hour, thanks to the action of the timer 36.

The lock according to the invention is also provided with an alarm system, to signal possible undue manipulations, comprising three sensors 49: a first thermal sensor, a second movement sensor and a third sensor formed by a microswitch for the door. Inside the lock, the sensors operate through a timer 50 a logic gate 51 which actuates an electronic switch 52 to energize an alarm siren or a warning light 53.

The 110—220 volt alternating current mains 54 are used as the primary electric power supply for the electric circuits which have just been described. From said mains the current is passed through a transformer which converts it to 13.5 volts. From there it passes to a diode bridge where it is converted into direct current. From this point the current passes to a 5 volt direct current regulator 58 which supplies the entire electronic system, except the mechanical lock, which is actuated by the solenoid 22, and the siren 53. In the event of a failure in the mains, the system would be supplied from the battery 25, through the logic gate 57; the invention also provides an auxiliary battery charging unit.

In the event of a failure in the main supply, a sensor 55 will activate a flashing unit 56 which makes the red lamp 11 commence flashing by action of the logic gate 37. The battery will then be connected and will assume the task of supplying the electric circuits of the device.

Finally, it has to be indicated that if for any reason the user loses or forgets the opening code set in the main storage, there is a master code which permits the lock to be opened, whatever may be the code existing in said main storage.

Referring now to Fig. 2, the key is designated therein with the general reference 101.

On the external end of the key there is a detachable handle 102. If anyone attempts to extract the key by force, this handle breaks off from the body of the key which remains inside the lock.

In front of the body of the key there is a reinforced stop 104 which limits the movement of the key. This stop is solidly connected with the door 103, shown in section, in said Fig. 2.

The body of the key is provided with an annular groove which cooperates with a cylindrical pin P, which prevents its extraction when the lock is engaged.

On the internal end of the body of the key, the latter makes contact with the microswitch M1, through duly positioned conductor rings 105. With the thickness and the number of rings, the separation between rings and the positioning thereof, it is possible to create extremely numerous combinations, as previously explained.

In Figs. 3A (key disengaged and door open), 3B (key blocked and shaft blocked lock) and 4, M1 designates the key microswitch; M2 the lock microswitch (open); M3 the lock microswitch (closed); and M4 the shaft R actuating microswitch. MP designates the control microcomputer. This very strong shaft R, controlled by the solenoid 122, blocks the pin P in the cases where said solenoid operates.

As has been said, an auxiliary battery is provided for the cases of main current cutoffs. However, since this is a low power battery, it cannot energize the solenoid, which cannot therefore actuate the strong shaft R; the result of this is that the pin P can be forced and the shaft can break. In order to provide for this contingency, the pin P and the manual actuator T are connected by a spring S so that the shaft cannot break on attempting to force the system.

Figs. 5A and 5B show, on the one hand, the lock unit assembly 201 and, on the other, the pertinent parts with which an authorized person can open the safe even if it is closed.

In the normal position, the lock unit has its latch 203 inserted in the hole 205 existing in the wall 207 of the safe, whereby the latter is kept closed.

When said authorized person wishes to open the safe, he inserts a special key in the keyhole 202 of the lock and turns the camming pin 204, which is applied against the slot 206 of the lock unit; this pin 204 pushes said slot and, consequently, the entire lock unit 201 backward, whereupon the latch 203 is released from the hole 205 and the safe is opened.

Figs. 6A and 6B, as well as Figs. 7A and 7B, show the rear cover of the safe, which normally prevents access to the mechanisms and mechanical systems thereof.

In the normal position (Figs. 6A and 6B), the latches 211, 212 and 213 are inserted in the holes 214, 215 and 216, respectively, of the walls of the safe, whereby the rear cover remains fixed.

On inserting the special key, these latches move and are released from the holes, passing to the position of Figs. 7A and 7B whereupon the entire rear cover can be removed, then attaining the desired access to the mentioned mechanisms and mechanical and electronic systems.

In the above description, the device of the invention has been spoken of in terms which might be called generic ones. This is due to the fact that all the electronic components are well known and they are available on the market under different embodiments. The functioning of same, isolately considered, is also known by experts on the matter.

Claims

1. A code type lock which comprises:

a lock means including a bolt and having a locking condition in which the bolt can engage with outside structure and an unlocking condition in which the bolt is disengaged from outside structure,

a direct current power source,

an electronic device for determining whether the lock means is in its locking or unlocking condition, said electronic device comprising a store (39), and input means (1) for entering a master code into the store (39) to be retained therein, comparison means (46) for comparing the master code with an opening code subsequently entered through said input means (1) and for providing a first output in the event that the opening code is identical to the master code and second output if the opening code is not identical to the master code, said electronic device keeping the lock means in its locking condition when said second output is provided and placing the lock means in its unlocking condition when said first output is provided to energise a solenoid (122) associated with a shaft (R) to release the bolt, characterised in that an erasing means (48) is provided for erasing the master code upon each unlocking of the lock means, said electronic device further comprises counting means (28) for registering the entry through said input means (1) of an opening code which is not identical to the master code and disabling the operation of the lock for a predetermined time when the number of registered opening codes which are not identical to the master code reaches a predetermined number and to initiate an alarm, and a plurality of lamps (10A, 10B, 11) for indicating the condition of the lock and the occurrence of at least a failure of the power supply.

2. A code type lock according to Claim 1 characterised in that the lock means, the store, the comparison means and the counting means are located inside of a safe or door and accessible for service personnel only.

3. A code type lock according to Claim 1 or 2 characterised in that the store (39), the comparison means (46), the counting means (28) and the input means (1) are combined in a control unit (MP, Fig. 3A) which is a microcomputer based unit.

4. A code type lock according to Claim 1 characterised in that when an incorrect opening code has been entered the plurality of lamps (10A, 10B, 11) start flashing/blinking.

5. A code type lock according to Claim 1 characterised by an alarm means (53) and means (49—52) for activating said alarm means when an attempt is made to manipulate the lock in which said lock means is mounted, in an unauthorised manner and at the same time the electric power supply (54) to the circuits is cut off.

6. A code type lock according to Claim 1 characterised in that the lock means in the locked condition can be manipulated, as an emergency measure, with an auxiliary key, which moves the lock means (201) (Fig. 5A, 5B) backward.

Revendications

1. Serrure du type à permutation qui comprend:

des moyens de verrouillage comprenant un pêne et ayant un état de verrouillage dans lequel le pêne peut s'enclencher avec une structure extérieure et un état de déverrouillage dans lequel le pêne est dégagé de la structure extérieure,

une source d'alimentation en courant continu,

un dispositif électronique pour déterminer si les moyens de verrouillage sont dans leur état de verrouillage ou de déverrouillage, ledit dispositif électronique comprenant une mémoire (39) et des moyens d'entrée (1) destinés à introduire un code maître dans la mémoire (39) pour qu'il y soit retenu, des moyens (46) de comparaison destinés à comparer le code maître à un code d'ouverture introduit ensuite par l'intermédiaire desdits moyens d'entrée (1) et à produire un premier signal de sortie dans le cas où le code d'ouverture est identique au code maître et un second signal de sortie si le code d'ouverture n'est pas identique au code maître, ledit dispositif électronique maintenant les moyens de verrouillage dans leur état de verrouillage lorsque ledit second signal de sortie est produit et plaçant les moyens de verrouillage dans leur état de déverrouillage lorsque ledit premier signal de sortie est produit afin d'exciter une bobine (122) associée à une broche (R) pour libérer le pêne, caractérisée en ce que des moyens (48) d'effacement sont prévus pour effacer le code maître à la suite de chaque déverrouillage des moyens de verrouillage, ledit dispositif électronique comprend en outre des

moyens (28) de comptage destinés à enregistrer l'introduction, par l'intermédiaire desdits moyens d'entrée (1), d'un code d'ouverture qui n'est pas identique au code maître et à empêcher le fonctionnement de la serrure pendant une durée prédéterminée lorsque le nombre de codes d'ouverture enregistrés, qui ne sont pas identiques au code maître, atteint un nombre prédéterminé, et à déclencher une alarme, et plusieurs lampes (10A, 10B, 11) destinées à indiquer l'état de la serrure et l'apparition d'au moins une défaillance de l'alimentation en énergie.

2. Serrure du type à permutation selon la revendication 1, caractérisée en ce que les moyens de verrouillage, la mémoire, les moyens de comparaison et les moyens de comptage sont placés à l'intérieur d'un coffre-fort ou d'une porte et ne sont accessibles qu'à du personnel de service.

3. Serrure du type à permutation selon la revendication 1 ou 2, caractérisée en ce que la mémoire (39), les moyens (46) de comparaison, les moyens (28) de comptage et les moyens d'entrée (1) sont combinés dans un bloc de commande (MP, figure 3A) qui est un bloc basé sur un micro-ordinateur.

4. Serrure du type à permutation selon la revendication 1, caractérisée en ce que, lorsqu'un code d'ouverture incorrect a été introduit, les lampes (10A, 10B, 11) commencent à clignoter.

5. Serrure du type à permutation selon la revendication 1, caractérisée par des moyens d'alarme (53) et des moyens (49—52) destinés à actionner lesdits moyens d'alarme lorsqu'une tentative porte sur une manipulation de la serrure dans laquelle lesdits moyens de verrouillage sont montés, d'une manière non autorisée et que, dans le même temps, la source (54) d'alimentation en énergie électrique des circuits est coupée.

6. Serrure du type à permutation selon la revendication 1, caractérisée en ce que les moyens de verrouillage, à l'état verrouillé, peuvent être manipulés, par mesure d'urgence, à l'aide d'une clé auxiliaire qui déplace les moyens de verrouillage (201) (figures 5A, 5B) ver l'arrière.

Patentansprüche

1. Codeschloß mit einer Verriegelungseinrichtung, die eine Falle enthält und die einen Verriegelungszustand, in welchem die Falle mit einem äußeren Aufbau in Eingriff gelangen kann, sowie einen Entriegelungszustand aufweist, in welchem die Falle von dem äußeren Aufbau gelöst ist,

mit einer Gleichstromspannungsversorgungsquelle,

mit einer elektronischen Einrichtung zur Bestimmung, ob die Verriegelungseinrichtung sich in ihrem Verriegelungszustand oder in ihrem Entriegelungszustand befindet,

wobei die elektronische Einrichtung einen Speicher (39) eine Eingabeeinrichtung (1) für die Eingabe eines Hauptcodes in den Speicher (39) zum Zwecke des Festhaltens in diesem Speicher, und eine Vergleichseinrichtung (46) enthält, die den Hauptcode mit einem Öffnungscodes vergleicht, der anschließend durch die betreffende Eingabeeinrichtung (1) eingegeben wird, und die ein erstes Ausgangssignal in dem Fall abgibt, daß der Öffnungscode identisch ist mit dem Hauptcode, und die ein zweites Ausgangssignal in dem Fall abgibt, daß der Öffnungscode nicht identisch ist mit dem Hauptcode,

wobei die elektronische Einrichtung die Verriegelungseinrichtung in ihrem Verriegelungszustand dann hält, wenn das zweite Ausgangssignal abgegeben wird, und die Verriegelungseinrichtung in ihren Entriegelungszustand dann bringt, wenn das erste Ausgangssignal abgegeben wird, um ein Magnetrelais (122) zu erregen, welchem ein die Falle freigebender Schaft (R) zugehörig ist, dadurch gekennzeichnet,

daß eine Löscheinrichtung (48) vorgesehen ist, die auf jede Entriegelung der Verriegelungseinrichtung hin den Hauptcode löscht,

daß die elektronische Einrichtung ferner eine Zähleinrichtung (28) aufweist, welche die Eingabe eines mit dem Hauptcode nicht identischen Öffnungscodes durch die genannte Eingabeeinrichtung (1) registriert und welche den Betrieb des Schlosses für eine bestimmte Zeitspanne sperrt, wenn die Zahl der mit dem Hauptcode nicht identischen registrieren Öffnungscodes eine bestimmte Zahl erreicht, und einen Alarm aulöst,

und daß eine Vielzahl von Lampen (10A, 10B, 11) vorgesehen ist, die den Zustand des Schlosses und das Auftreten zumindest eines Ausfalls der Spannungsversorgung anzeigen.

2. Codeschloß nach Anspruch 1, dadurch gekennzeichnet, daß die Verriegelungseinrichtung, der Speicher, die Vergleichseinrichtung und die Zähleinrichtung innerhalb eines Geldschrankes oder einer Tür untergebracht und lediglich für Servicepersonal zugänglich sind.

3. Codeschloß nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Speicher (39), die Vergleichseinrichtung (46), die Zähleinrichtung (28) und die Eingabeeinrichtung (1) in einer Steuereinheit (MP, Fig. 3A) kombiniert sind, die eine Einheit auf der Grundlage eines Mikrocomputers ist.

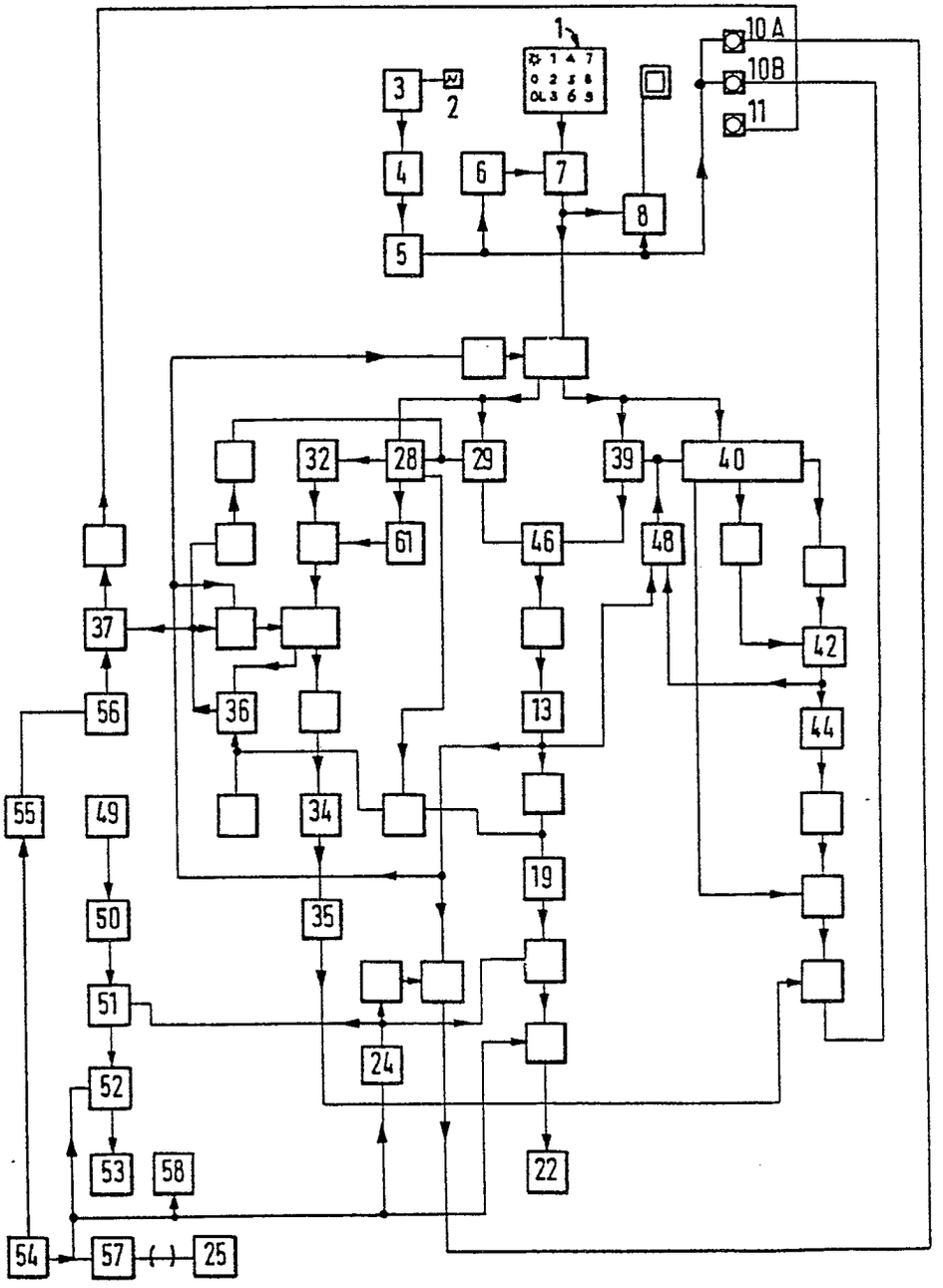
4. Codeschloß nach Anspruch 1, dadurch gekennzeichnet, daß in dem Fall, daß ein unrichtiger Öffnungscode eingegenen worden ist, die Vielzahl der Lampen (10A, 10B, 11) beginnt aufzublitzen/zu blinken.

5. Codeschloß nach Anspruch 1, dadurch gekennzeichnet, daß eine Alarmeinrichtung (53) und Einrichtungen (49—52) vorgesehen sind, welche die Alarmeinrichtung in dem Fall aktivieren, daß ein Versuch unternommen wird, das Schloß, in welchem die Verriegelungseinrichtung untergebracht ist, in einer nicht authorisierten Weise zu manipulieren, und daß zu-

gleich die elektrische Spannungsversorgung (54) für die Schaltungen abgeschaltet wird.

6. Codeschloß nach Anspruch 1, dadurch gekennzeichnet, daß die Verriegelungseinrichtung im verriegelten Zustand als Notmaßnahme mit einem Hilfsschlüssel manipuliert werden kann, der die Verriegelungseinrichtung (201, Fig. 5A, 5B) zurückbewegt.

Fig. 1


1
10A
10B
11
3
2
4
6
7
8
5
32
28
29
39
40
61
46
48
37
42
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57
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Fig. 2

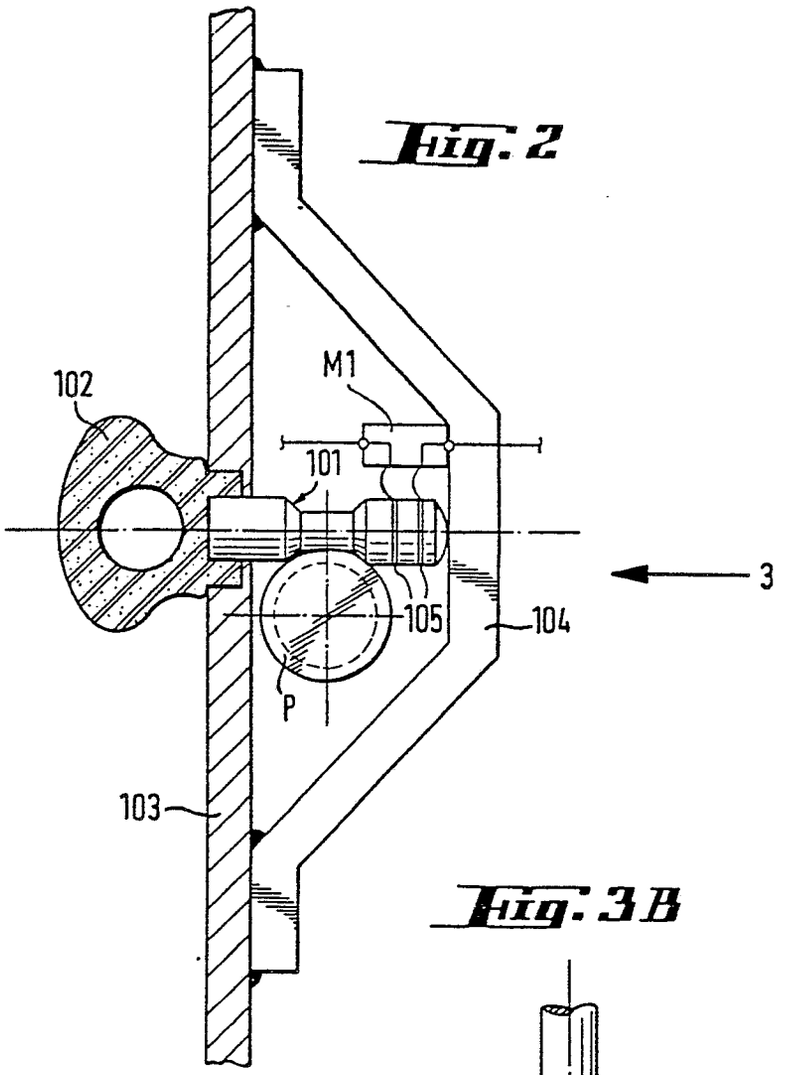


Fig. 3B

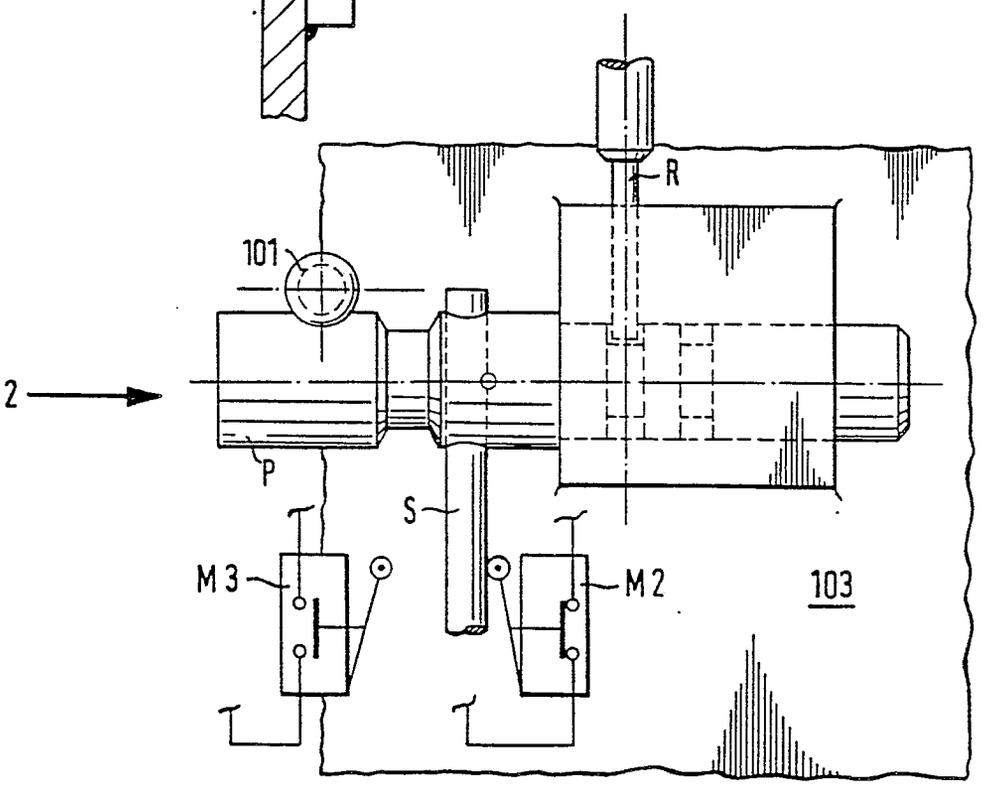
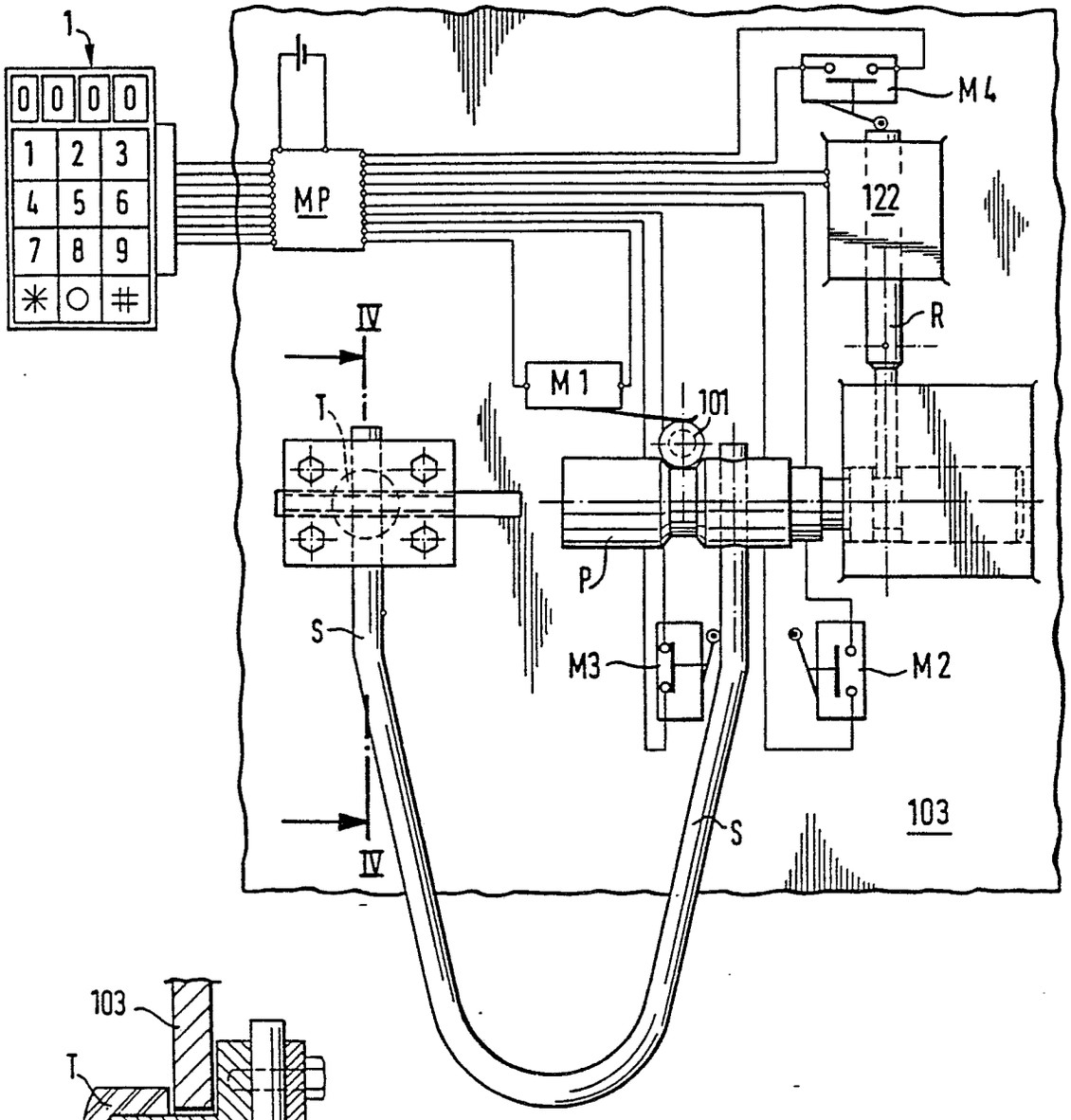


Fig. 3A



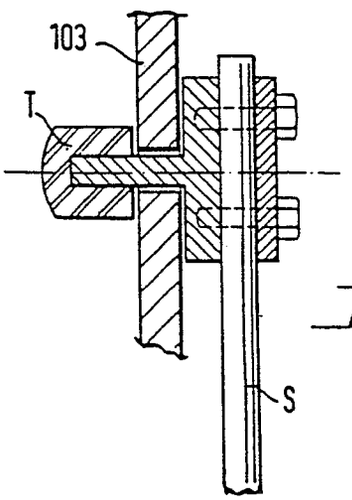


Fig. 4

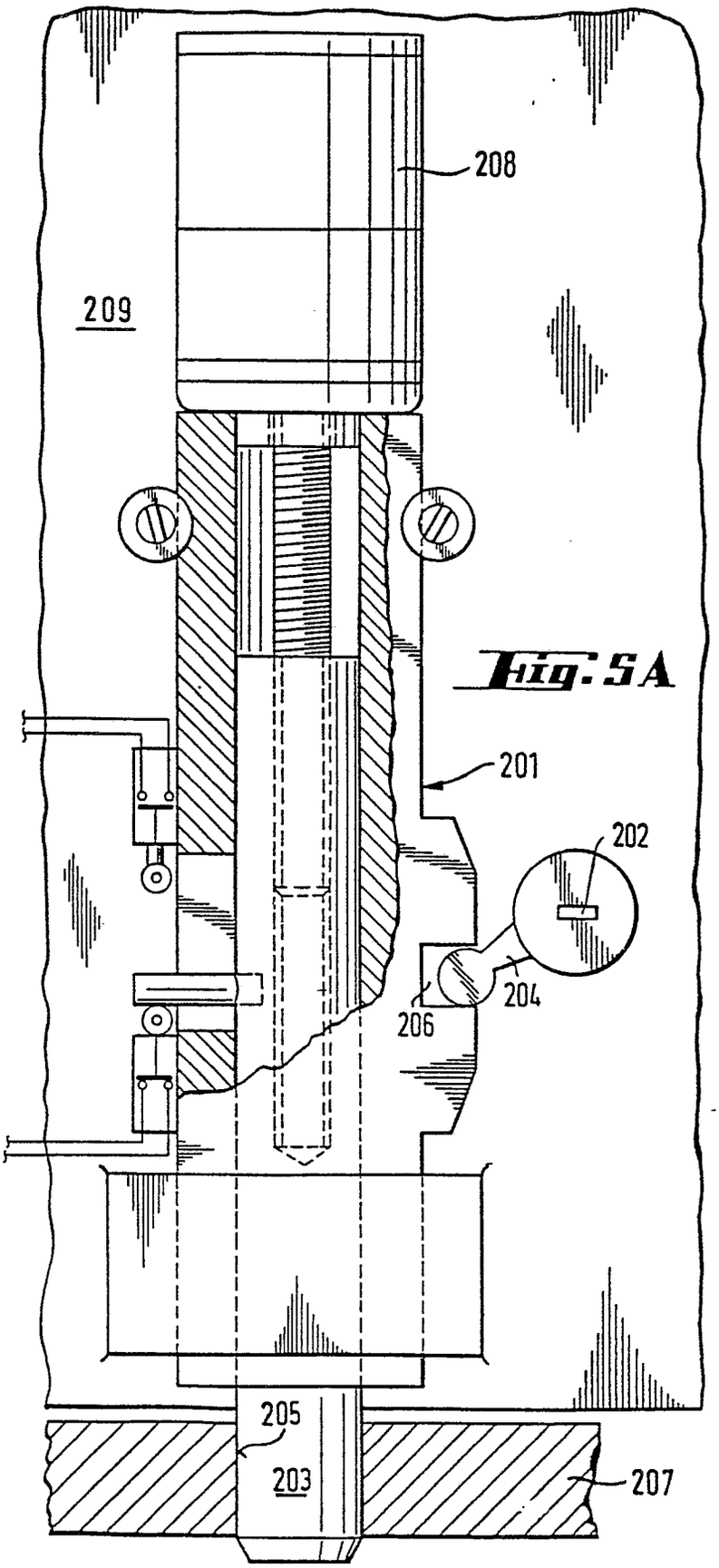


Fig. 5A

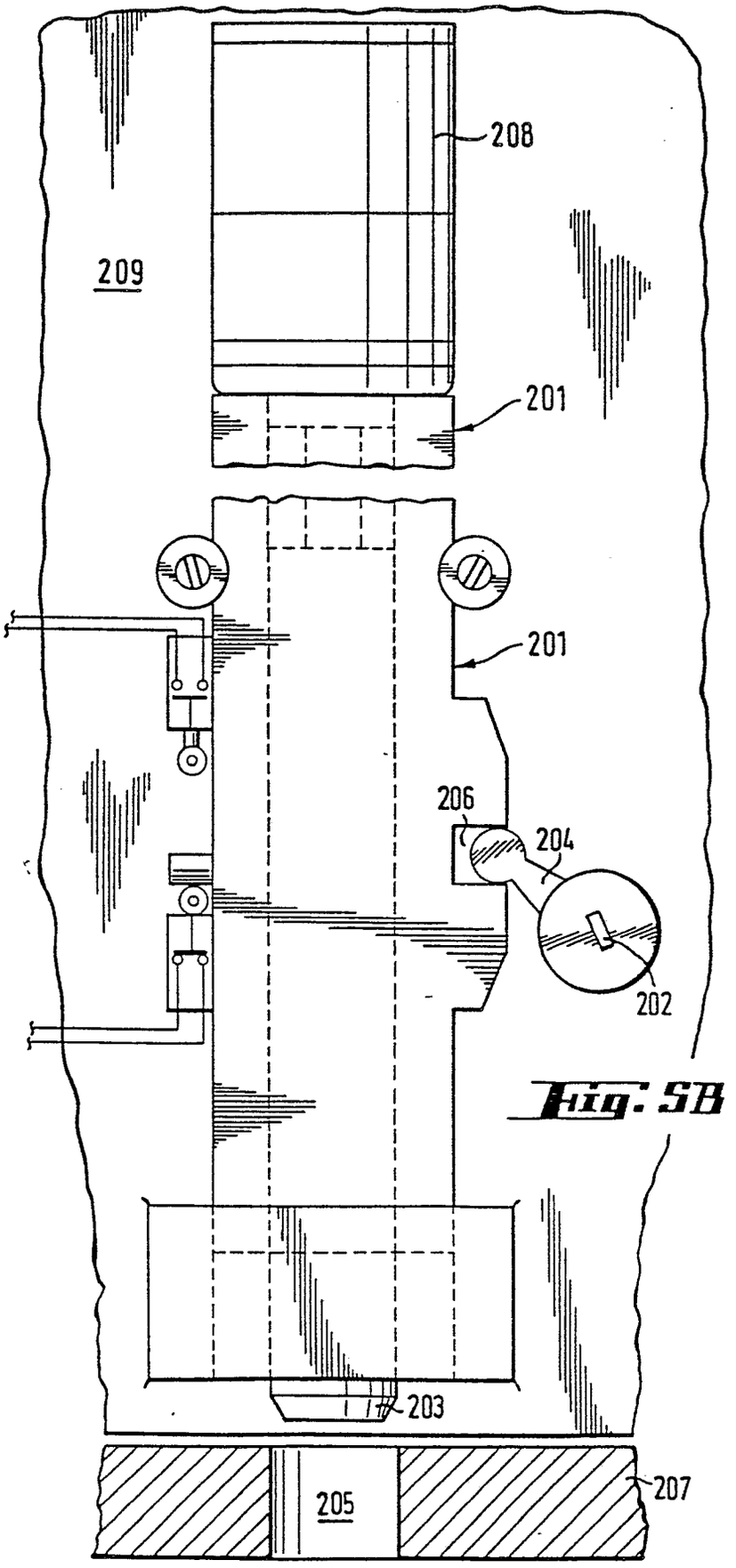


Fig: 5B

Fig. 6B

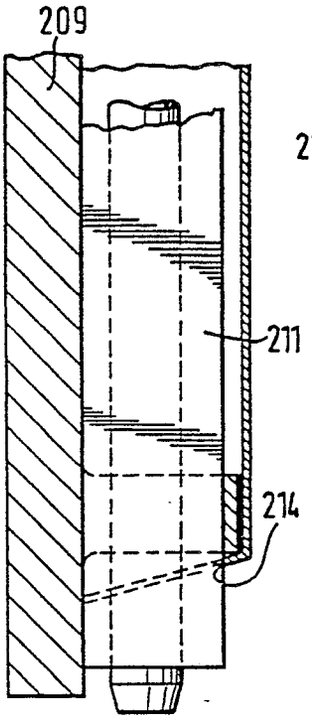


Fig. 6A

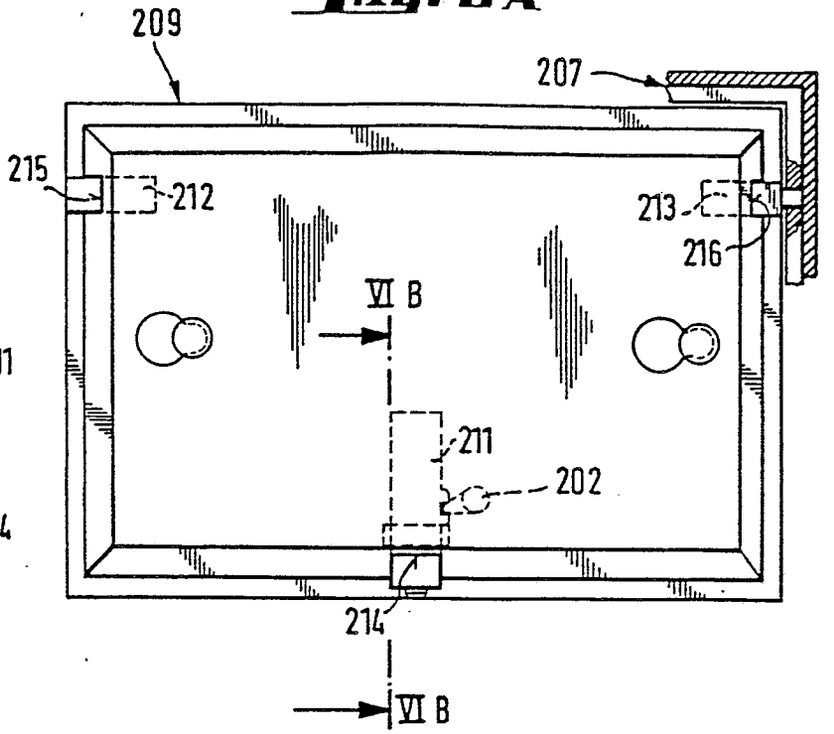


Fig. 7B

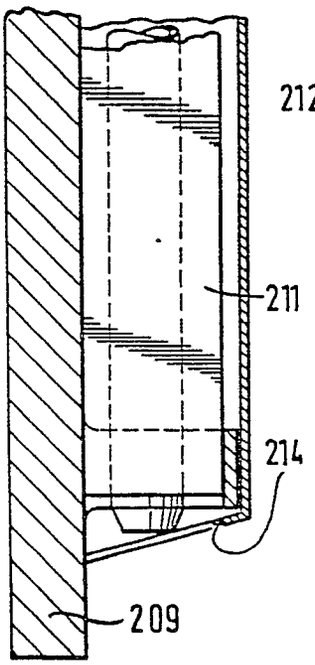


Fig. 7A