United States Patent [19]

Mauer

[11] **Patent Number: 4,602,491**

[45] **Date of Patent: Jul. 29, 1986**

[54] **COMBINATION LOCK**

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[73] Assignee: **Werner Mauer GmbH & Co. KG**, Heiligenhaus, Fed. Rep. of Germany

[21] Appl. No.: **663,446**

[22] Filed: **Oct. 19, 1984**

[30] **Foreign Application Priority Data**

Oct. 19, 1983 [EP] European Pat. Off. 83110400.5

[51] **Int. Cl.**[4] **E05B 37/12**

[52] **U.S. Cl.** **70/312**; 70/306; 70/317

[58] **Field of Search** 70/312, 315-318, 70/306

[56] **References Cited**

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Primary Examiner—Robert L. Wolfe
Assistant Examiner—Russell W. Illich
Attorney, Agent, or Firm—Ralf H. Siegemund

[57] **ABSTRACT**

The combination lock includes several encoding buttons, a latch plate is slidably movable between two terminal positions and has a plurality of locking pins; a plurality of lock disks each have on one side a radial groove for respectively engaging the locking pins or being disengaged therefrom, each disk further having on its outer side a diametrical groove in which respective slide locks are permitted to slide, an encoding release slide moves said slide locks; a plurality of gears are respectively connected to the encoding buttons and positioned for engagement with the slide locks, the gears are prevented from turning, thereby preventing the encoding buttons from being turned when the respective slide lock engages the gear and the locking pins are situated in the respective radial grooves, the gears are coupled to the lock disks when the locking pins are out of the respective radial grooves, the release slide when moving the slide locks decouples the lock disks from the gears and the encoding button; and resiliently biased tumblers are associated with the gears such that the gears are releasable only in the end positions of said latch plate.

10 Claims, 18 Drawing Figures

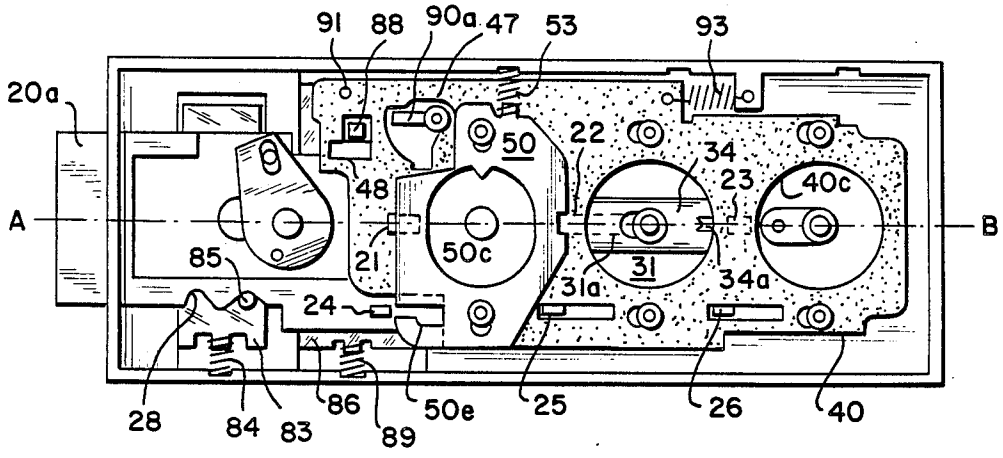
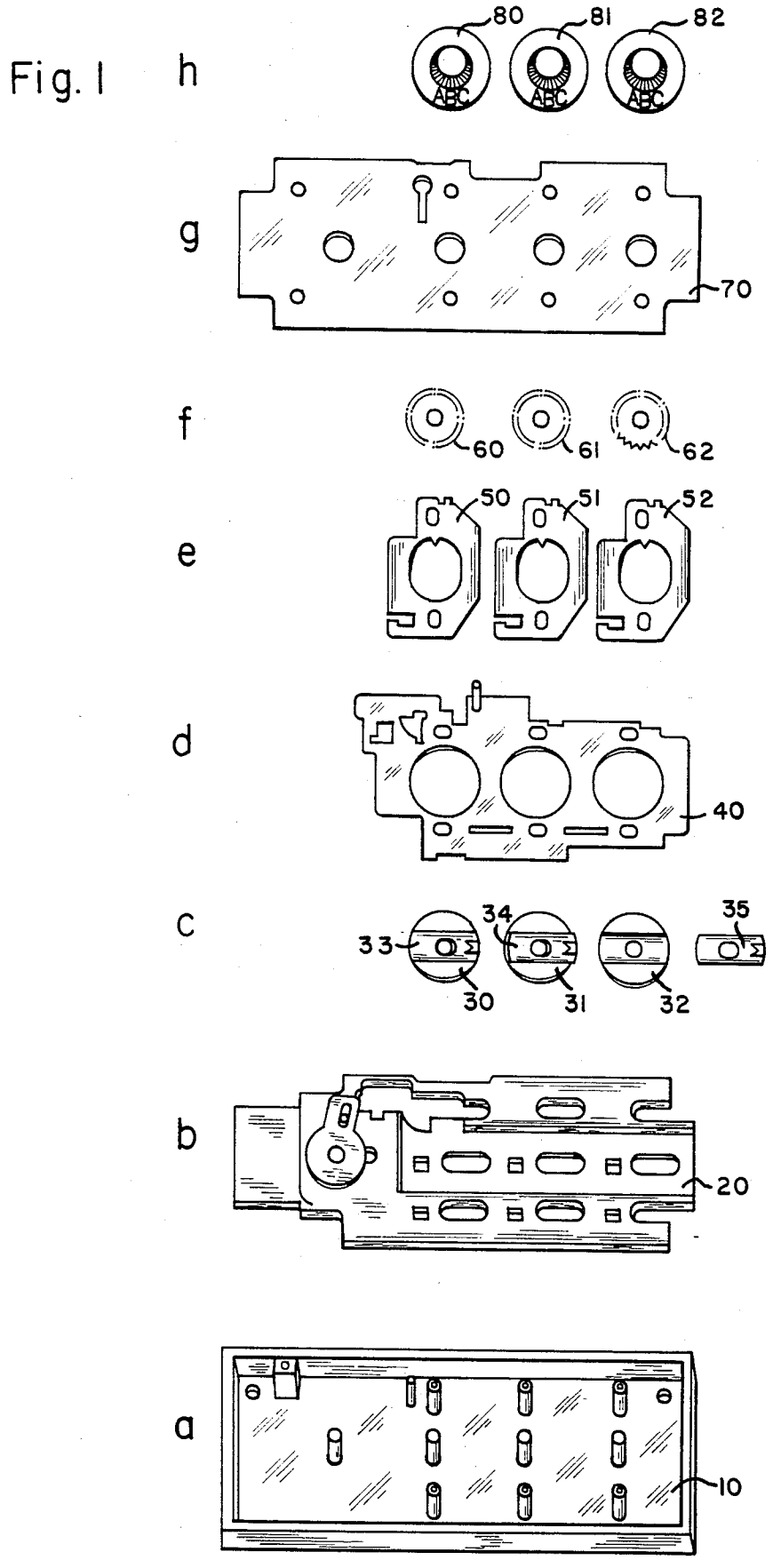


Fig. 1



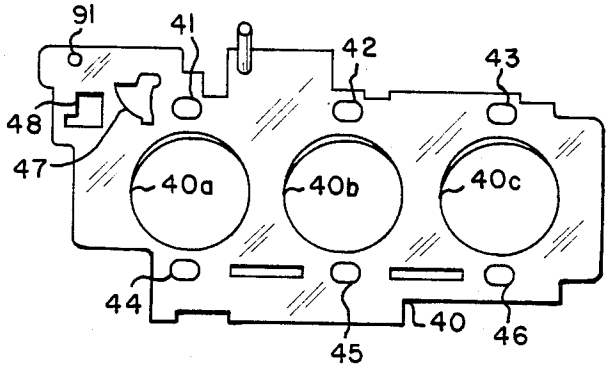


Fig. 5

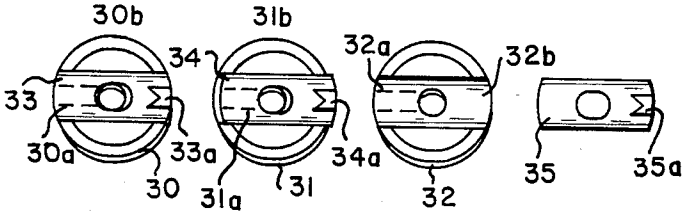


Fig. 4

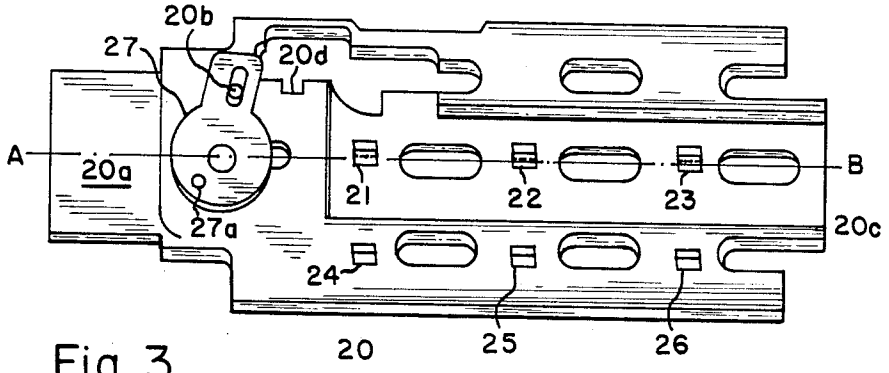


Fig. 3

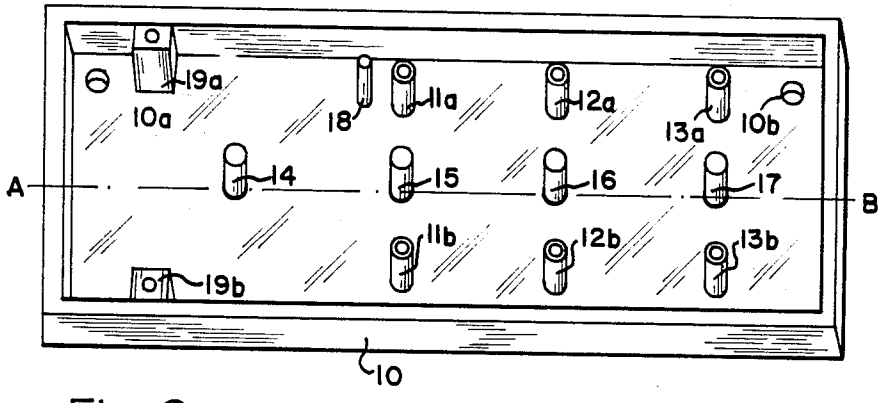


Fig. 2

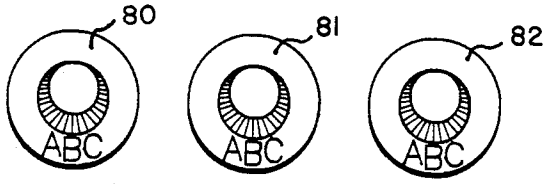


Fig. 9

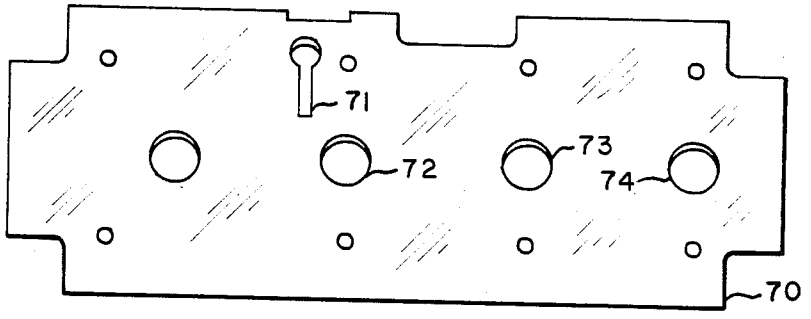


Fig. 8

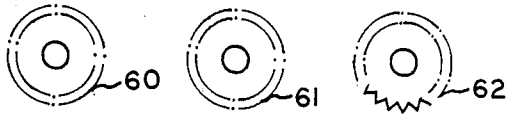


Fig. 7

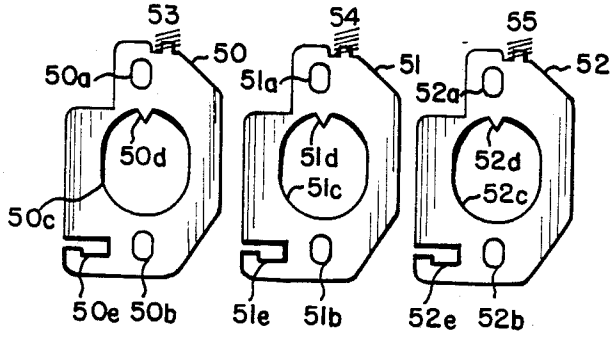


Fig. 6

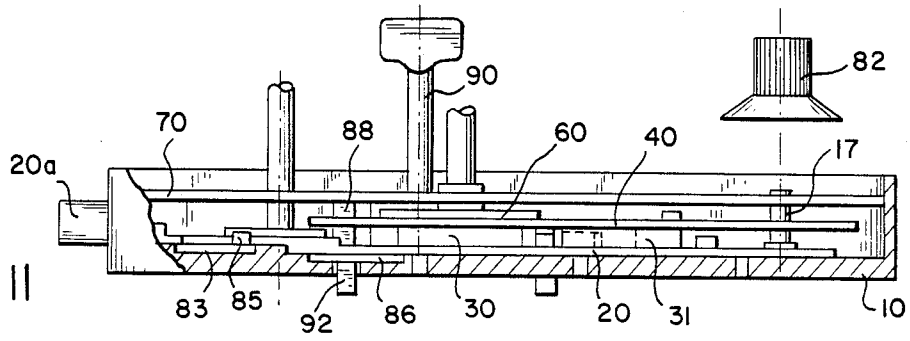


Fig. 11

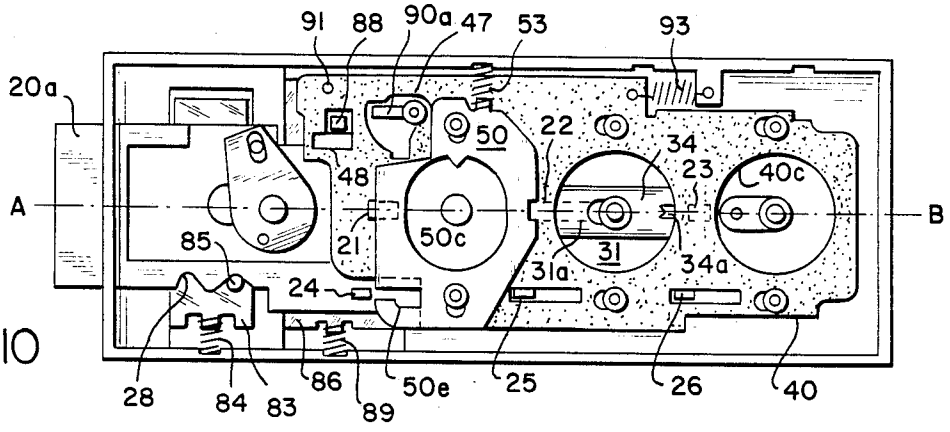


Fig. 10

Fig. 12

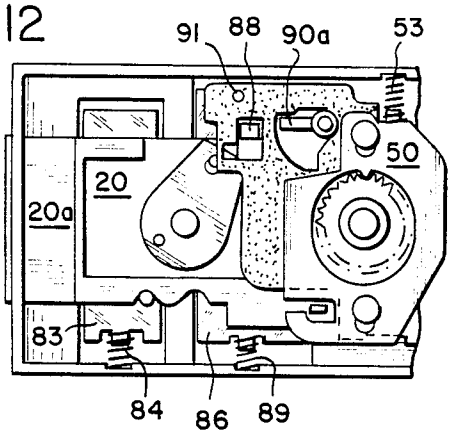
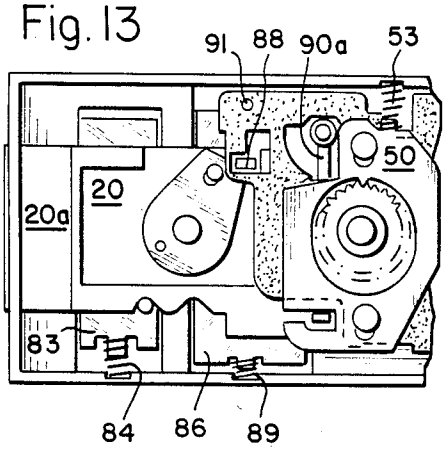


Fig. 13



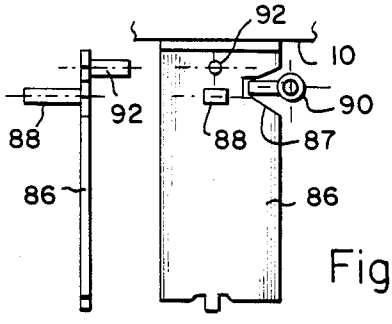


Fig. 16

Fig. 14

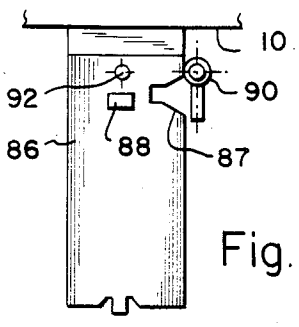


Fig. 15

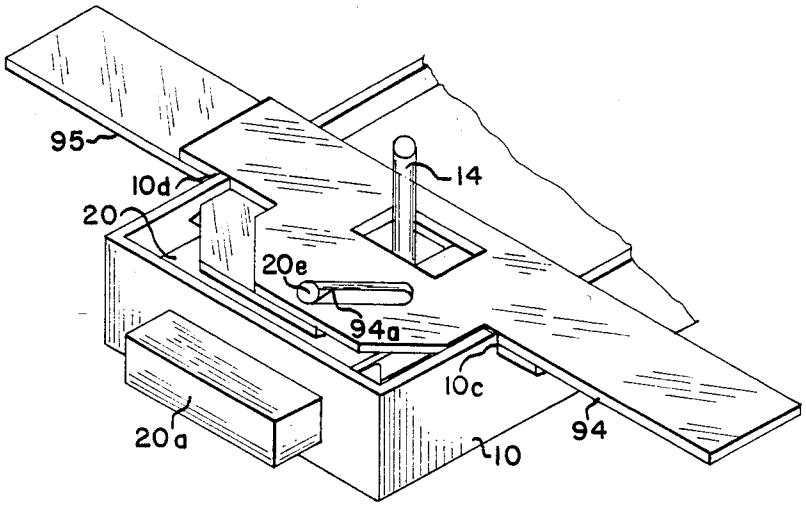


Fig. 17

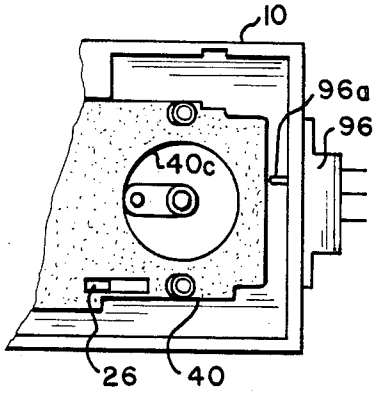


Fig. 18

COMBINATION LOCK

BACKGROUND OF THE INVENTION

The present invention relates to a combination lock with several encoding buttons to be used for locking containers, boxes or the like, and including a latch movable in between two terminal positions; the latch has a plate which carries a particular number of locking pins cooperating with a corresponding number of rotatable locking disks which in turn are controlled by the encoding buttons. Moreover, a common readjustment or encoding release slide is provided for decoupling the encoding buttons and the locking disks.

U.S. Pat. No. 3,053,071 discloses a device for adjusting the locking and opening conditions for a strong box or the like, using permutation locks with several adjustable disks which are associated with axially displaceable locking disks. The engagement of the locking disks with the adjusting disks is releasable for purposes of readjustment towards a different encoding pattern for unlocking. The locking disks are peripherally provided with engagement spaces, which in case of properly adjustment of the device for opening face the scanning or locking fingers of a latching plate. This latching plate is actuated from the outside through a manual device, whereby the scanning or locking finger enters the engagement space of the locking disks. In order to provide for a new encoding, a control plate is provided for being actuated from the outside, and the locking engagement between the locking disks and the adjustment disks can be overcome by means of ball shaped pressure parts.

German Pat. No. 2,918,235 discloses a permutation lock which can be regarded a development arising from the U.S. patent discussed earlier. This permutation lock does not use a control plate provided just for purposes of re-encoding the lock. Rather, the latching plate in the latter patent is constructed so that it does not only provide a scanning function, but also the function of a locking member for purposes of re-encoding. The latching plate is punched in such a manner that in case of an undercut engagement a rather larger areal, crescent shaped, raised locking zone is established. The latching plate moreover is provided with three locking fingers which, in the case of correct positioning, engage the detent or spaces of the three locking disks. Since the axes of the locking disk are arranged along one line, and since the latching plate is pivotable about an axle pin having a particular distance from the aforementioned straight line, it develops that the turning circles of the locking fingers are differently large. In the case of a locked lock, and in case of a slight load on the handle to adjust the trap disk, a locking finger will slide on the locking disk. Thus, with a "fine feel", one can in fact scan the position of the detents. Through repetition of that kind of probing at the next disk, one can in fact lift the secret of the encoding without any damage to the lock, and the lock can thus be opened and reclosed without a trace.

DESCRIPTION OF THE INVENTION

It is an object of the present invention to provide a combination lock for strong boxes, i.e., containers for valuables such as safes in a hotel, safety boxes in banks or the like, and meeting high demands as to quality and security, with particular emphasis on safety against trial and error attempts to open the lock, while the user and owner of the facility can change the combination at any time, and in a very simple manner.

In accordance with the preferred embodiment of the present invention, it is suggested to improve combination locks of the type outlined above by providing each locking disk on the side facing the respective latch plate with a radial slot facing a pin on the latch plate; moreover, each locking disk is provided on the opposite side with a diagonal or diametrical groove carrying a locking slide, all of which are guided by an adjustment slide and engages a gear connected with an encoding button; moreover, each gear is associated with a resiliently biased tumbler which will be released only in the terminal position of the lock.

DESCRIPTION OF THE DRAWING

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention, it is believed that the invention, the objects and features of the invention, and further objects, features and advantages thereof will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. **1** is an exploded view of the essential components of the lock in accordance with the preferred embodiment of the present invention for practicing the best mode thereof;

FIG. **2** is a perspective view from the top of the lock box or casing;

FIG. **3** is a perspective view of the latch plate;

FIG. **4** illustrates three lock disks;

FIG. **5** illustrates a top view of an encoding release slide;

FIG. **6** illustrates three tumblers;

FIG. **7** illustrates somewhat schematically three gears in alignment with the tumblers of FIG. **6**;

FIG. **8** illustrates a top view of the lock cover;

FIG. **9** is a top view of the three encoding buttons shown in alignment with the gears of FIG. **7**;

FIG. **10** is a top view into the lock box with extended latching plate and additional detail;

FIG. **11** is a partial section and side view of the arrangement shown in FIG. **10**;

FIGS. **12** and **13** are two side views of an inserted latch plate, the figures differ by the position of the encoding release slide;

FIGS. **14** and **15** illustrate two different possible positions of a control slide as controlled through an adjusting key being visible in part but partially covered in FIGS. **12** and **13**;

FIG. **16** is a side view of the control slide shown in FIGS. **14** and **15**.

FIG. **17** illustrates a variation of the key of the lock with a particular kind of break down rod; and

FIG. **18** is a modification or, better, supplement under utilization of a microswitch.

Proceeding now to the detailed description of the drawings, reference is made first to FIG. **1**. The exploded view has been, for ease of reference, identified additionally through the levels A, B, C, D, E, F, G and H. Herein then the level A illustrates the lock box **10** or casing shown in greater detail in FIG. **2**. The level B in FIG. **1** illustrates the latch plate **20** shown in greater detail in FIG. **3**. The level C in FIG. **1** illustrates the three lock disks **30**, **31** and **32**, respectively, associated with locking slides **33**, **34** and **35**. The FIG. **4** illustrates this assembly in greater detail. The level D in FIG. **1**

illustrates the encoding release slide **40**, shown in greater detail in FIG. **5**. The level E in FIG. **1** shows the three tumbler devices **50**, **51** and **52**, details thereof are shown in FIG. **6**. The level F in FIG. **1** shows three gear disks **60**, **61** and **62**, repeated in FIG. **7**. The level G in FIG. **1** shows a lock cover **70**, shown in greater detail in FIG. **8**, and the level H in FIG. **1** finally illustrates the three encoding buttons **80**, **81** and **82**, also shown in FIG. **9**. It can thus be seen that these parts shown in exploded view in FIG. **1** are assembled in that the box or container **10** contains the parts shown in levels B through F; the container or case is then closed by the cover **70**, and the encoding buttons (level H) project from that cover. This casing or box or container is then affixed to the strongbox, safe, or the like, particularly the door thereof, and cooperates with a fixed member in which the latch part of latch plate **20** is inserted for closing the strongbox.

Turning now to FIG. **2**, there is illustrated the lock box, case, or container **10** which is preferably made by means of pressure casting. The bottom of the lock box is provided with pairs of guide pins **11***a*, **11***b*; **12***a*, **12***b*; **13***a*, **13***b*; and each of these pins is provided with a threaded bore. These pins are arranged in a symmetrical relation, as can be seen with regard to an axes A-B. Certain additional pins extend upwardly from the bottom of casing **10**. They are designated by reference numerals **14**, **15**, **16** and **17**. They are guide posts or pins for the latch actuating handle, as well as for the encoding buttons **80**, **81** and **82**.

Reference numeral **18** in FIG. **2** denotes a guide post for the code exchange key, and two blocklike elements **19***a* and **19***b* are provided on opposite long side walls of the casing **10**, and they are provided with threaded bores for receiving fastening screws. Moreover, the four corners of the bottom of the casing **10** are provided each with a fastening bore, the two bores **10***a* and **10***b* can be seen directly; the two other bores are hidden behind the lower long front wall of the case.

The latch plate **20**, as shown in FIG. **3**, is preferably also made by a cast alloy, just as the casing **10** is made. In the left end, plate **20** carries the latch **20***a* proper. The plate **20** is provided with two series of oblong slots which are received by the pins **11***a* through **13***b*. Blocklike pins **21**, **22** and **23** are arranged along the axis A-B; these are the locking pins of the lock. They engage respectively radial slots **30***a*, **31***a*, and **32***a*, respectively, of the locking disk **30**, **31** and **32**, as shown in FIG. **4** in the unlocked or open position of the lock. In the locked position these radial slots are misaligned so that the pins **21**, **22** and **23** cannot enter them. Additional blocklike locking pins **24**, **25** and **26** extending from the plate **20** in FIG. **3** engage certain slots of the tumblers as shown in FIG. **6**.

An eccentric disk **27** is placed on the latch plate **20**, and is mounted by means of the pin **14** as it extends from the bottom of case **10** (see FIG. **2**). This disk **27** causes the latch plate **20** in its entirety to follow linearly a turning motion through the pin **20***b* as it extends from the plate **20** into an oblong slot of disk **27**. The eccentric disk **27** in turn is turned through a pin **27***a* engaging a latch actuator which is not shown. Thus, on turning disk **27** via this latch actuator or handle, the arm with the slot receiving pin **20***b* shifts latch plate **20** back and forth.

In the central portion **20***c* of latch plate **20** a rectangular indentation is provided which receives the locking disk **30**, **31** and **32** of FIG. **4**. Each of these disks is, as stated above, provided on its underside with a radial slot **30***a*, **31***a*, and **32***a*, respectively, which the pins **21**, **22** and **23** engage or in which they are inserted whenever the lock is opened. The upper sides of the disks **30**, **31** and **32** are provided with diametrical grooves **30***b*, **31***b* and **32***b*, respectively, which in turn receive the lock slides **33**, **34** and **35**. The right-hand end of each of these slides carries locking teeth, respectively denoted by reference numeral **33***a*, **34***a* and **35***a*.

FIG. **5** illustrates the encode release or readjusting slide **40** having three circular and relatively large openings **40***a*, **40***b* and **40***c*. The diameter of the respective circles corresponds to the diameter of the round disks **30**, **31**, **32** as well as the length dimensions of the lock slides **33**, **34** and **35**. The slide **40**, however, is disposed in such a manner above the lock disks **30**, **31** and **32** so that upon adjustment of slide **40** in the direction of the axis A-B, only the lock slides **33**, **34** and **35** are carried along. The slide **40** itself is guided through the aid of oblong slots **41**, **42**, **43**, **44**, **45** and **46** receiving pins **11***a* . . . **13***b*. The slide **40** is adjusted, i.e., shifted either by means of a pin **91**, or through an adjusting key **90** which engages a particularly contoured slot **47**.

The tumbler elements **50**, **51** and **52** of FIG. **6** are respectively provided with oblong slot pairs **50***a*, **50***b*; **51***a*, **51***b*; **52***a*, **52***b*, and these slots receive the pins **11***a*, **11***b*, etc., through **13***b*. This way devices **50**, **51** and **52** are guided for being shifted transversely to the axis A-B. Each device **50**, **51** and **52** is provided moreover with a slightly oval indent **50***c*, **51***c*, and **52***c*, respectively, merging at the respective upper end into an inwardly extending tooth **50***d*, **51***d*, and **52***d*, respectively. Each of the tumblers **50**, **51** and **52** is additionally provided with a particularly contoured slot **50***e*, **51***e*, **52***e*. Each of these slots has a narrow entrance portion and a somewhat wider interior portion. They are provided for respectively receiving the pins **24**, **25** and **26**, whereby a pin, such as **24**, etc., when in the narrow slot portion prevents the respective tumbler from moving in a direction transversely to the axis A-B. While on the other hand, the pins **24**, etc., when received by the wider portion of the slot such as **50***e*, etc., are permitted to undergo limited motion transversely to the axis A-B which is a direction of the oblong contour of an opening such as **50***a*, etc.

FIG. **7** merely shows for purposes of completion the three gear disks **60**, **61** and **62**, which through not illustrated hollow shafts are connected to the encoding buttons **80**, **81** and **82**, as shown in FIG. **9**. These hollow shafts project through openings **72**, **73**, **74** in the lock cover **70**. The hollow shafts receive the guide posts **15**, **16** and **17** as projecting from the bottom of the case **10**. The heights of the various parts are adjusted so that the gearing of the disks **60**, **61** and **62** engages the locking teeth **33***a*, **34***a*, and **35***a*, respectively, as well as the single tooth **50***d*, **51***d*, and **52***d*, respectively. The devices **50**, **51** and **52** are held in engagement with the teeth of gear disk **60**, **61** and **62**, respectively, through coil springs **53**, **54** and **55**, as shown in FIG. **6**.

After having described the various components under due consideration of the aligned illustration of FIGS. **2** through **9**, we now turn to FIG. **10**, which illustrates a top view of a partially assembled lock. The latch **20***a* is assumed in this figure to have been advanced to a locking position. Underneath latch plate **20** is provided an indent slide **83**, which is movable transversely to the axis A-B. This slide **83** ensures that the latch will assume only one of two positions, and in a

stable configuration. This stability is attained through a coil spring **84**, a pin **85**, and a curved cam portion **28** of the latch plate **20**.

A control slide **86**, also shown in FIGS. **14**, **15** and **16**, is actuated through the key bit **90***a* of an adjusting key **90**. This slide **86** carries a blocklike locking pin **88** and is held through a coil spring **89** in the illustrated, normal position. In this position slide **40** as well as control slide **86** are mutually blocked because the pin **88** abuts the latch plate **20**. In other words, the spring **89** pushes the slide **86** in a direction which is up in FIG. **10**. The upper edge of latch plate **20** holds the pin **88** against the upper edge of the slot **48**. Release from this position is possible only if through lateral shifting of latch plate **20** the cutout **20***d* is brought into alignment with the pin **88** so that the pin **88** can enter that cutout.

FIG. **11** illustrates the position of assembled parts in accordance with FIG. **10**. One can see the slides **83** and **86** as being disposed between the bottom of the casing **10** and the latch plate **20**. One can also see the key **90**. In the illustrated closing position or locking position, pins **21**, **22** and **23** are respectively disengaged from the locking disks **30**, **31** and **32**. Thus, turning of these disks permits misalignment of their radial slots with respect to the pins. Moreover, the locking pin **24** does not engage slot **50***e* of device **50** (the situation is similar with regard to pins **25**, **26** and slots **51***e*, **52***e*). It is thus apparent that in the locking position the encoding buttons **80**, **81** and **82** can be freely adjusted to thereby destroy the original combination setting in which slots **30***a*, etc., were aligned with pins **21**, etc., and to establish randomly a new one. If one were to attempt at that point to slide the latch **20***a* back, pins **21**, **22** and **23** will abut the periphery locking disk **30**, **31** and **32**, respectively. After the proper combination has been restored in buttons **80**, etc., the locking slides **33**, **34** and **35**, and disks **30**, **31**, **32**, return to the disposition shown in FIG. **4**, and now the latch can in fact be opened (pivoting of disk **27**) because the radial slots of the disk **30**, **31**, **32** are again aligned with the pins **21**, **22**, **23**, respectively.

Only in an open position of the lock corresponding to FIGS. **12** and **13** is it possible to actually change the combination. In this position, locking pin **88** faces the cutout of recess **20***d* of the latch plate **20**, and upon shifting slide **86**, pin **88** links recess **20***d* and blocks latch slide **20** so that the latch is in fact blocked during the adjusting towards a new combination setting. Moreover, the locking disks **30**, **31** and **32** are blocked and held against rotation in the open position via the pins **21**, **22** and **23**, while on the other hand, through the locking key **33***a*, **34***a* and **35***a* the gears **60**, **61**, **62** are blocked to thereby block the encoding buttons. In the open position of the latch the encoding buttons are therefore in an adjusting position representing the old combination such as A, B and C, for example. In deviation from the illustrated structure, the blocking teeth **33***a*, **34***a*, and **35***a* can be replaced by mechanically stabilized locking segments.

The authorized user of the strongbox of which latch and lock is a part can change the code only after the lock is unlatched as described. In order to permit re-encoding we must first shift the control slide **86** in down direction as stated until the locking pin **88** connected with the slide **86** releases the slide **40**. This release is obtained through the L-shaped configuration of the slot **48** because if upon shifting the control slide **86** the pin **88** so to speak moves down along the stem of the L, it will become aligned with the foot part of the L (compare FIGS. **12** and **13**). Now slide **40** is shifted into the right-hand end position through the coil spring **93**. Accordingly, the locking or blocking teeth **33***a*, **34***a*, and **35***a* disengage from the gears **60**, **61**, and **62**, thereby releasing the encoding buttons from a position in which they are prevented from turning. As long as the teeth **33***a*, **34***a*, and **35***a* engage these gears, they cannot be turned as long as the pins **21**, **22**, and **23** are in the radial slots of the disks **30**, **31**, and **32**, which is the case when the lock is open. Now the slide **40** has in fact interrupted the connection between the encoding button and the locking disks **30**, etc. Accordingly, these buttons can be set to a new position while the disks **30**, **31**, and **32** are maintained in a locked open position.

The tumbler devices **50**, **51** and **52**, respectively through their teeth **50***d*, **51***d* and **52** impart a digitalization upon the movement of the encoding buttons. Each of these devices **50**, **51** and **52** is moved up and down as the respective coding button is turned and their teeth snap back into the gearing. As can be seen by comparing FIGS. **12** and **13** with FIGS. **10**, a pin such as **24** is out of the slot **50***e* of the respective tumbler such as **50**. However, in the latch open position, as per FIGS. **12** and **13**, this pin **24** has entered the wide portion of opening **50***e*. As now each of these tumblers **50**, **51**, and **52** is moved up and down during adjustment of the respective encoding button, the wise portion of these slots **50***e*, **51***e*, and **52***e* do indeed permit this limited motion of the respective tumbler. The narrow portion of each of these slots **50***e*, **51***e*, and **52***e*, however, will prevent such an up and down motion of the tumblers, which means that these tumblers can move up and down only when the latch is either completely open or closed. If during encoding one of the devices **51**, **52** and **53** happen to be stopped on a tooth that is in between two encoding positions, then latch motion is in fact blocked through the respective control slot. Conversely, as stated the encoding buttons cannot be adjusted when the latch remains in an in-between position; the tumblers will prevent it. Thus, the digitalization imparts upon the system an aspect of definite and discrete positions; in-between positions are so-to-speak prohibited, and their attainment is in fact prevented. All these various interlocking features as described will render in fact the lock foolproof, because even in case of correct manipulation it will not attain a disposition or operating state in which it is locked to such an extent that only drilling, i.e., brute force is required to open.

Basically, the lock is available, or is to be made available, in two versions. Version **1** will be used for long-term users, i.e., in banks or in homes where the user in fact doesn't change. Version **2** will be employed in case the user changes, i.e, for example in hotels where the same strongbox or room safe will be assigned to different guests at different times. These aspects are realized as follows: In version **1** the control slide **86** is moved through the pin **92** as shown in FIG. **16**, which is fastened to the rear of the slide **86** and reaches through the lock casing into the strongbox itself. Another pin **91** which also projects from the rear of the lock casing is connected to the slide **40**. The respective positions of the slides **40** and **86** are shown in FIGS. **12** and **13**.

As stated, the cutout **48** has an L-shaped or angular contour, which in turn causes the control slide **86** to be blocked whenever the slide **40** assumes the position for changing the combination. The slide **40** carries the lock slides **33**, **34** and **35** through the cutout **40***a*, **40***b* and **40***c* such that the gears **60**, **61** and **62** are decoupled and

disengage the locking teeth **33***a*, **34***a* and **35***a*. Consequently the encoding buttons **80**, **81** and **82** can now be readjusted to change from the old combination, such as A, B and C, to a new one, such as X, Y and Z. If one now returns the slide **40** (to the left) through the pin **91**, spring **89** forces the control slide **86** in upward direction, and the slide **40** is again blocked. For example, one may now inspect the device and, for example, through a trial run with open door of the strongbox, the latch can be advanced (FIG. **10**) and one may see whether or not the adjustment was properly made, whereupon the box can be properly closed and the combination "destroyed", i.e., the buttons will not be adjusted to a random position.

Version **2** is as stated to be used, for example, in hotels, which of course poses a particular and special conditions. For example, the user, such as guest in a hotel, should be in a position to adjust a particular combination without anybody knowing it, including any of the hotel personnel. On the other hand, it must be made sure that after the guests has departed, the container or room safe is in fact unlatched, otherwise a very extensive search may ensue, and the container or box is in fact unusable for a long period of time. If the whereabouts of a guest remains unknown, or if the guest has in fact forgotten the combination which he has adjusted, it seem that the only possibility is to partially destroy the lock in order to open the strongbox. However, in order to avoid these problems, the lock in this hotel version is used without the pins **91** and **92** being provided, and instead it comes with a key **90**. Only in case of an open latch and in the release position of slide **40**, can the key be inserted into the keyhole **71** or withdrawn therefrom! Thus, it is incumbent upon the hotel personnel to demand the key from the guest when he departs. This way the strongbox is open with certainty and the buttons are not locked to the previous encoding position. The lock can indeed be re-encoded by the next user of the same room and the strongbox.

The key **90** is inserted into the key bit cutout **87** of the slide **86**, as well as in the corresponding cutout **47** of the slide **40**. FIG. **14** illustrates the normal position (key not removable); FIG. **15** the encoding position (key can be inserted and removed). Since the keyhold **71** (FIG. **8**) is arranged transversely to the axis A-B of the lock, the key **90** can indeed be removed only from the re-encoding position as per FIG. **15**. In this position, however, latch **20***a* is blocked. This means that the container can be opened or closed only when the key **90** is inserted, and has the position as shown in FIG. **14**. This particular solution has the significant advantage that the hotel personnel, for example, in the reception, is sure that the lock is unlocked when the guest returns the key.

Of course it is apparent that the two versions are to a considerable extent identical, whereby all parts which are made through cutting or stamping are similar. In order to avoid manipulation it is advisable, however, to provide the lock casing without oblong slots for the re-encoding pins if the lock is to be used in the hotel version for the system. Thus, no pins will be affixed to the slides **40** and **86** in this instance.

FIG. **17** illustrates a special version of the so-called breakdown or lifter action type. In this case the side walls of the lock casing **10** are provided with cutouts **10***c* and **10***d* in which rods **94** and **95** are guided. They are moved through obliquely positioned oblong slots, such as **94***a*, by means of a driver pin **20***e* mounted on the latch plate **20**. Since the latch plate **20** is adjusted through a special handle under utilization of the guide pin **14**, no problem arises, contrary to single button combination locks to transfer this supplemental torque.

A supplemental version of the lock is shown in FIG. **18**. In the right-hand portion of the casing **10** a microswitch **96** is mounted to the front wall facing away from the latch. The plunger **96***a* of this microswitch scans the rear edge of the slide **40**. In this version then a contact is actuated whenever the slide is in the re-encoding position, i.e., when the strongbox door is opened. Therefore, in this hotel version of the lock the disposition of the lock can be signalled to a remote place such as a special indicator in the hotel reception in order to make sure that the door of the lock is open when the guest departs.

The two versions can be operated in accordance with the following operating instructions: The opening of the lock is carried out through adjusting the encoding buttons to the preselected combination and the latch handle is turned to the right. For locking, this handle is turned to the left, and the combination is destroyed through random positioning of the encoding buttons. In order to adjust the device to a new combination, version **1** requires that the control slide pin **92** is shifted down so that the re-encoding slide **40** is released for releasing the encoding buttons so that indeed a new combination can be selected. Having done that, the slide **40** is shifted back by means of the pin **91**.

Version **2** for the hotel use requires the utilization of key **90**, which is tunred by 90 degrees in order to release again the slide **40**. Now the new combination is adjusted and the key is turned to the right, but cannot be withdrawn. In the changing position, i.e., in that position in which a new combination can be adjusted while the lock is in fact open, the key can be released to be handed to the receptionist for reuse by the next guest.

It is customary to provide 26 adjusting positions on the encoding buttons, for example, for the letters of the alphabet. This means that with three encoding buttons one obtains 26^3, i.e., 17,576 combinations. If one uses four combination buttons, one obtains 456,976 combinations. If one adds the digits 1 through 9 to the 26 letters of the alphabet, three encoding buttons permit 42,875 combinations. Of course another possibility for increasing safety through increase in the number of combinations is to provide two locks with separate encodings in a door. It is believed, however, that for practical purposes the three adjusting button versions 26^3 combinations constitutes a best mode of realizing the invention.

Other important aspects in the realization are to be seen in that at least the casing, the latch plate, the locking disks, the locking slides, and the encoding buttons are made through pressure casting. The flat part, such as the slide **40** and the devices **50**, **51** and **52**, are preferably punched out part under utilization of sheet metal.

The new combination lock is quite economical to make, very simple to operate, and quite safe. The changes in combinations can be carried out by unskilled users such as hotel guests in a few seconds even through they are not familiar with the construction in a few seconds. Thus, contrary to the single axle combination locks, this version is quite suitable for broad use in hotels, banks or the like. The decisive advantage of this lock, however, is that owing to the internal locking and latching mechanism, it is impossible to open the lock simply through fine feel scanning.

The invention is not limited to the embodiments described above, but all changes and modifications thereof

not constituting departures from the spirit and scope of the invention are intended to be included.

I claim:

1. Combination lock with encoding buttons extending from a lock case comprising:

a latch plate slidably mounted in said case and movable between two terminal positions, the latch plate having a plurality of locking pins;

an adjustable encoding release slide;

a plurality of lock disks each having on one side a radial groove for resepctively engaging the locking pins or being disengaged therefrom, each disk further having on its other side a diametrical groove in which respective slide locks are permitted to slide, there being means in the encoding release slide for moving said slide locks;

a plurality of gears respectively connected to said encoding buttons and positioned for engagement with said slide locks, said gears being prevented from turning, thereby preventing the encoding buttons from being turned when the respective slide lock engages the gear and the locking pins are situated in the respective radial grooves, the gears being coupled to the lock disks when the locking pins are out of the respective radial grooves, said release slide when moving said slide locks decoupling the lock disks from the gears and the encoding button; and

resiliently biased tumblers associated with said gears such that the gears are releasable only in the end positions of said latch plate.

2. Combination lock as in claim 1 wherein said adjustable encoding release slide and said latch plate are movable in parallel directions, said tumblers being positioned for resilient replacement in an orthogonal direction.

3. Combination lock as in claim 1, said latch plate having additional locking pins cooperating with control slots in said tumblers to permit their release only in the terminal positions of said latch plate.

4. Combination lock as in claim 1, there being guide pins in said case for guiding slide movement of said release slide and of said latch plate.

5. Combination lock as in claim 1 and including a control slide movable in a direction transverse to a direction of movement of said latch plate, said control slide carrying a lock pin cooperating with said release slide and said latch plate such that actuation of said latch plate is prevented when said encoding release slide has a disposition in which said slide locks are decoupled from said gears.

6. Combination lock as in claim 1 and having a cover with a keyhole for insertion of a key, said key provided for shifting said release slide, said key being removable only when said release slide is in the release position in which said slide locks are decoupled from said gear and said locking pins are inserted in said radial grooves.

7. Combination lock as in claim 1, said adjustable encoding release slide being spring biased tending to pull the release slide into the release position.

8. Combination lock as in claim 1, there being manual operable means connected or connectable to said release slide for shifting the slide between its positions, there being an additional control slide for blocking the latch plate when the release slide is in the release position, said control slide being manually operable.

9. Combination lock as in claim 1 and including electric sensing means for monitoring the disposition of said release slide.

10. Combination lock as in claim 1 including an actuator pin on said latch plate cooperating with two bars movable in opposite directions to each other and transversely to the direction of movement of said latch plate, there being oblique slots in said bar for engagement by said actuator pin.

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