(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 111 363**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **83201693.5**

(51) Int. Cl.³: **E 05 B 35/08**

(22) Date of filing: **30.11.83**

(30) Priority: **09.12.82 GB 8235159**

(43) Date of publication of application:
20.06.84 Bulletin 84/25

(84) Designated Contracting States:
BE FR GB IT LU NL SE

(71) Applicant: **Chubb Lips Nederland BV**
Merwedestraat 48 P.O. Box 59
NL-3300 AB Dordrecht(NL)

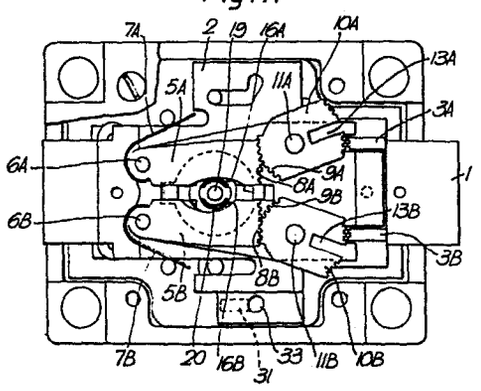
(72) Inventor: **Van Doorn, Anthonie**
Vijverlaan 148
NL-3319 SV Dordrecht(NL)

(74) Representative: **Obee, Robert William**
Manor House Manor Lane
Feltham Middlesex TW13 4JQ(GB)

(54) Change-key locks.

(57) In a change-key lock (Fig 1) there are two packs of levers 5A,5B meshing with respective packs of rotary tumblers 10A,10B. The bolt 1/2 carries two stumps 3A,3B which can be withdrawn into notches 13A,13B in the rotors 10A,10B when the latter are aligned by a double-bitted key lifting the levers 5A,5B. The pivot pins 11A,11B for the rotors are carried by a shiftable plate 12 (Fig 3), normally locked by a lever 27. To reprogramme the lock the existing correct key is first used to align the rotor notches 13A,13B with the stumps 3A,3B; an auxiliary "change" key inserted to keyhole 31 then lifts the lever 27 and shifts the plate 12 to carry the rotors out of engagement with the levers and pass the rotor notches over the bolt stumps; the existing correct key is replaced by the new key which sets the levers to correspondingly new positions; and the "change" key is turned back to re-engage the rotors with the levers in their new positions. In another embodiment (Fig 7) designed especially for safe deposit lockers the bolt is split into two portions 50/51 and 52 controlled by separate sets of tumblers 53C and 53A/53B requiring the use of two different keys, tumbler set 53C being reprogrammable independently of tumbler sets 53A/53B.

Fig.1.



EP 0 111 363 A2

Fig.3.

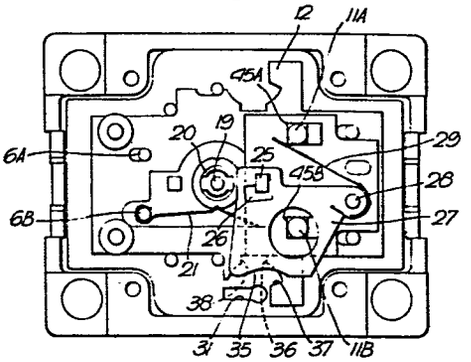
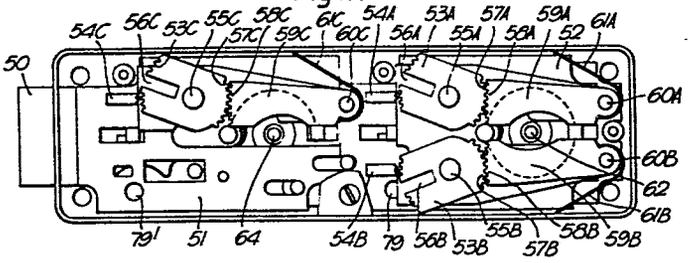

12
11A
45A
20
19
25
29
6A
45B
28
6B
27
26
21
38
31
35
36
37
11B

Fig.7.


54C
56C
53C
55C
57C
58C
59C
6C
60C
54A
56A
53A
55A
57A
58A
59A
52
61A
50
60A
60B
62
61B
79'
51
64
54B
79
56B
53B
55B
57B
58B
59B

Change-Key Locks

This invention relates to change-key locks, by which we mean key-operated locks having provision for reprogramming of the key-recognition mechanism to pass differently-coded keys, without requiring the replacement of the key-recognition elements. These locks may find useful application in various contexts. For example it may be desired to change the coding of the lock of a safe or the like security enclosure at regular intervals to minimise the risk of compromise; in safe deposit locks a "custodian" locking mechanism may need to be changed for similar reasons or, perhaps more frequently, the "client" locking mechanism has to be changed whenever the associated safe deposit box is re-let; in hotels too, it is most desirable that the coding of locks is changed frequently to reduce the risks of theft through the use of duplicated, stolen or retained guests' keys. In any such case it is clearly both time consuming and expensive to have to replace physically the key-recognition elements whenever a change of coding is required.

In accordance with the present invention there is provided a change-key lock of which the key-recognition mechanism comprises a set of movable tumblers and a set of levers or other movable key-engaging elements each one of which is normally in driving engagement with a respective said tumbler; the key-engaging elements and tumblers normally being biased to positions in which the tumblers block the retraction of a bolt or other locking member but the tumblers being drivable by the respective key-engaging elements to unlocking positions in which they permit such retraction, when the key-engaging elements are moved by a correct key; wherein the tumblers are borne relative to the key-engaging elements such that the tumblers can be withdrawn from such elements to break said driving

engagement, only when the tumblers are in said unlocking positions; and wherein said driving engagement can be re-established with the key-engaging elements in different relative positions to those in which said engagement was broken.

Such a lock thus can be reprogrammed by withdrawing the tumblers from the key-engaging levers or the like elements, after the tumblers have been set into their unlocking positions by use of the correct key, and then re-engaging the tumblers and key-engaging elements with the latter set in new relative positions by engagement with the new key which it is desired to pass, such positions being those to which the new key will set the key-engaging elements to achieve unlocking during subsequent use of the lock.

Two embodiments of a lock in accordance with the invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows the mechanism of the first embodiment, with the cover plate of the lock removed;

Figures 2 and 3 are views similar to Figure 1 with further components of the lock removed;

Figure 4 illustrates the bolt of the lock of Figures 1 to 3;

Figure 5 illustrates the form of key by which the lock of Figures 1 to 3 is operated;

Figure 6 illustrates the form of auxiliary key which is used during the reprogramming of the lock of Figures 1 to 3; and

Figures 7 to 9 are views similar to Figures 1 to 3 of the second embodiment of the invention.

Throughout the following description all expressions of relative direction, position or movement, such as "leftwards", "rightwards", "clockwise", "anti-clockwise", "near side", "far side", and the "clock" notation of angular position, refer to the directions, positions or movements in the sense in which they are viewed in the respective figures.

Referring to Figures 1 to 3, there is illustrated a change-key lock in accordance with the invention which may be used eg for locking the boltwork of a safe or vault door. This lock has a reciprocable bolt (seen also in Figure 4) which includes a head 1 secured to a plate 2, with two elongate stumps 3A, 3B upstanding from the plate behind the head. Movement of the bolt between its illustrated thrown position and a withdrawn position is controlled by a double-bitted key 4 (shown in Figure 5) as will be described below.

As shown in Figure 1, the lock is equipped with two packs of levers 5A, 5B pivoted on respective pins 6A, 6B and biased towards their illustrated rest positions by respective springs 7A, 7B. Each lever has a sector of gear teeth 8A,8B which normally mesh with the complementary teeth 9A,9B of a respective member of two sets of rotary tumblers (hereinafter called "rotors") 10A,10B borne on respective pins 11A,11B. While the lever pivot pins 6A,6B are mounted in fixed position in the lockcase the rotor pivot pins 11A,11B are carried by a second reciprocable plate 12 (Figure 3) for use in reprogramming the lock as is more fully described hereafter. It will be appreciated from Figure 1 that when the bolt 1/2 is thrown and the key

removed the bolt is deadlocked by the rotors 10A,10B blocking return movement of the two stumps 3A,3B respectively. The rotors are, however, provided with notches 13A,13B which when aligned with the stumps 3A,3B permit bolt retraction under the control of the correct key, as will now be described.

It will be seen from Figure 5 that the two bits 14A,14B of the key 4 are of different heights, bit 14B being the taller. Each bit has a series of steps 15A,15B to cooperate with the (equal) bellies 16A,16B of the levers 5A,5B respectively, and the taller bit 14B has an additional step 17 for throwing and withdrawing the bolt. The key is inserted into the lock from the near side as viewed in Figures 1 to 3, in the "quarter to three" position and with the taller bit 14B to the left. The cover plate of the lock (omitted from the drawings) embodies a key aperture complementary to the cross-section of the bitted end of the key so that the key can only be inserted into, and removed from, the lock in this single orientation. The end of the key stem also has an axial bore 18 which fits over a fixed guide pin 19 in the lock as the key is inserted. A barrel element 20, (the purpose of which is to act as a further guide for the key and to shield the lever bellies 16A, 16B from reading) is borne rotatably around the pin 19, and has transverse slots to receive the two key bits 14A,14B. A spring detent 21 (Figure 3) is provided for the barrel element 20 to retain it in the "quarter to three" position except when being turned with the key.

To withdraw the bolt the key is turned on the pin 19 in the clockwise direction. During the first half-revolution of the key the steps 15B of the taller bit 14B engage, lift and then release the levers 5A while the steps 15A of the

shorter bit 14A engage, lift and then release the levers 5B; at the same time the bolt step 17 of the key revolves freely in the central cut-out 22 of the bolt plate 2 (see Figure 4 - the axis of rotation of the key in relation to the bolt in this condition is indicated at X).

Having been turned through 180°, further clockwise rotation of the key engages the bit 14A with the bellies 16A of the levers 5A and the bit 14B with the bellies 16B of the levers 5B so that now each lever 5A and 5B is lifted through the correct angle appropriate to unlocking. By virtue of the connection between the gear teeth 8A/9A and the gear teeth 8B/9B lifting the levers 5A and 5B imparts corresponding rotation to the rotors 10A and 10B (clockwise and anti-clockwise, respectively) to bring the various notches 13A,13B into alignment with the stumps 3A and 3B respectively; if any lever 5A or 5B is under or over-lifted by use of an incorrect key the corresponding rotor 10A or 10B will not reach, or will move past, the position in which its notch 13A,13B aligns with the respective stump 3A or 3B, and withdrawal of the bolt will remain blocked. Assuming that the correct key has been used, while the notches 13A, 13B and stumps 3A,3B remain aligned the bolt step 17 of the key engages a talon face 23 on the bolt plate (Figure 4) to retract the bolt leftwards, in so doing the stumps 3A,3B sliding into the respective series of rotor notches 13A or 13B. The bolt comes up against stops at the limit of its withdrawing movement with the key at an approximately "twenty to two" position, from which it is precluded from further clockwise movement by the engagement of its bolt step 17 with face 23.

The thus-retained key can only be removed after re-throwing and locking the bolt, by anticlockwise rotation of the key

back to its insertion position. During the first part of this rotation its bolt stump engages another talon face 24 on the bolt plate (Figure 4) to throw the bolt rightwards to its locking position, and the key bits 14A and 14B release the levers 5A and 5B respectively. During the last half-revolution of the key its bit 14B again engages, lifts and releases the levers 5A while the bit 14A engages, lifts and releases the levers 5B - causing each lever to be engaged by the "wrong"key bit in this way each time the bolt is withdrawn or thrown serves to confuse any attempt by a potential safebreaker to discover the correct key stepping by "reading" the wear of the lever bellies eg with an endoscope. As the levers 5A,5B move back to their rest positions under the bias of springs 7A,7B during the final part of the anticlockwise rotation of the key the rotors 10A,10B are of course returned to their initial misaligned positions once more to deadlock the bolt.

It will be appreciated that the angle through which an individual rotor 10A or 10B is turned to align its notch 13A or 13B with the corresponding stump 3A or 3B to permit bolt-retraction, is related to the angle through which the associated lever 5A or 5B is lifted by the key, or in other words to the height of the corresponding step 15A or 15B on the relevant key bit. By reselecting the starting positions of the rotors, therefore, the lock can be "reprogrammed" for operation by a differently-stepped key, and the means by which such reprogramming can be achieved to pass a new key will now be described.

Essentially the reprogramming process involves the disengagement of the gear teeth of the levers 5A,5B and rotors 10A,10B, and their re-engagement in new relative positions. To effect such disengagement the plate 12

carrying the rotor pivot pins 11A, 11B must be slid rightwards a short distance. Normally such movement is blocked by a fixed stump 25 engaging in the slot 26 of an auxiliary lever 27 (Figure 3) which is pivoted on a pin 28 carried by the plate 12 and biased to the illustrated rest position by a spring 29. The plate 12 can, however, be freed and shifted by use of an auxiliary "change" key 30, shown in Figure 6.

More particularly, to reprogramme the lock, which must be initially in its thrown condition as illustrated in Figure 1, the change key 30 is first inserted through a keyhole 31 from the far side of the lockcase, and so that the stem portion 32 of this key (Figure 6) extends into a hole 33 in the bolt plate 2; this action effectively locks the bolt against movement in either direction during the subsequent operations. The existing operating key 4 is then inserted and turned on pin 19 in the clockwise (unlocking) direction as far as it will go. With the bolt now immovable, this key is stopped in an approximately "twenty-five past eleven" position when the bolt step 17 abuts the face 23 of the bolt. In this position, however, the key bits 15A and 15B have engaged and lifted the respective levers 5A and 5B to turn the corresponding rotors 10A,10B into the positions in which their notches 13A, 13B align with the respective stumps 3A, 3B. The change key is now turned clockwise (in the sense of Figure 3) so that its bit 34 (Figure 6) engages the belly 35 of lever 27 and lifts that lever into a position in which the stump 25 now lies in the "gate" portion of the lever slot 26, thus freeing the plate 12 for movement. Further rotation of the change key brings its bit into engagement with a talon face 36 on the plate 12 to shift the plate rightwards, rotation of the key eventually being checked by a stop face 37 on the plate. Shifting the

plate in this manner of course also takes the pins 11A, 11B to the right and with them the rotors 10A,10B, so that the gear teeth 8A/9A and 8B/9B become disengaged. There is no rotary movement of the rotors during this phase of the operation because, as they shift to the right, the aligned rotor notches 13A and 13B slide over the stumps 3A and 3B to maintain all of the rotors in the aligned condition.

The key 4 is then turned back anti-clockwise and removed from the lock, the rotors 10A, 10B remaining disengaged from the levers 5A,5B and engaged with the stumps 3A,3B. The new key which it is desired that the lock should pass is inserted in place of the old key and turned clockwise as far as it will go. This key is stopped by the face 23 in the same "twenty-five past eleven" position as before, with the levers 5A,5B appropriately lifted, the positions which the levers now adopt of course differing from those which were set by the previously-passed key to the extent that the steppings 15A,15B of the new key bits differ from those of the previous key.

Next, the change key 30 is turned back anticlockwise and removed from the lock. During this movement its bit 34 engages a talon face 38 on the plate 12 to shift that plate leftwards back to its normal operative position, in which it is locked by the stump 25 in the slot 26 when the change key finally releases the belly 35 and the lever 27 returns to its rest position under the bias of the spring 29. As the plate 12 carrying the rotors 10A,10B returns leftwards, the gear teeth 8A/9A and 8B/9B of the levers 5A,5B and rotors 10A,10B are re-engaged and the rotor notches 13A, 13B are disengaged from the stumps 3A,3B. The relative rotational positions in which individual levers and rotors are now engaged of course differ from the relative positions

which pertained with the previously-passed key to the extent that the levers 5A,5B have been lifted to different positions by the new key 4. The lock is now effectively reprogrammed to pass the new operating key. Returning the key anticlockwise to its insertion position misaligns the rotors 10A,10B as the levers 5A,5B are released, leaving the bolt 1/2 deadlocked. The angle by which each individual rotor notch 13A,13B is now misalinged from the respective stump 3A,3B is the angle through which that rotor will be turned by the corresponding lever 5A,5B when lifted by the corresponding new key steps 15A,15B when the new key is subsequently used for unlocking.

It will be appreciated that reprogramming of the lock cannot take place without the participation of the existing correct key because the rotors 10A,10B must be in the aligned positions to permit their withdrawal from the levers 5A,5B (this is otherwise blocked by the stumps 3A,3B). Also of course, because access to the rear side of the lock is required for insertion of the change key 30, the associated safe door must first be unlocked and opened. The plate 12 could not be shifted with the bolt 1/2 in its retracted position, however, because of the blocking action of the stumps 3A,3B within the rotor notches.

From Figure 2 it is seen that behind each pack of levers 5A,5B a single additional lever 39A,39B is pivoted on the respective pin 6A,6B, and biased by a respective spring 40A,40B. These are not provided with corresponding rotors 10 but are "conventional" levers in that each is provided with a racking slot 41A,41B which cooperates with an additional stump 42A or 42B upstanding from the bolt plate 2. These levers normally act as an additional block on the movement of the bolt, but are lifted by steps 43A,43B of the key bits 14A and 14B (Figure 5) to free the stumps 42A,42B for movement when the correct key is

turned to throw or withdraw the bolt. These levers are not reprogrammed and the respective key steps 43A,43B are therefore of the same height for all keys. They also serve the purpose of preventing the change key 30 from being inadvertently turned back to reengage the rotors 10A,10B with the levers 5A,5B at the point during the reprogramming sequence described above where the previous operating key 4 has been removed from the lock but before the new operating key is inserted. As seen in Figure 2, in the normal rest positions of the levers 39A,39B a nose portion 44A,44B of each lever is stopped against a square section 45A,45B at the base of the respective rotor pivot pin 11A,11B. When the plate 12 carrying the pins 11A,11B has been shifted to the right by the change key, however, removal of the operating key 4 releases the levers 39A,39B to drop past their normal rest positions so that the noses 44A and 44B are placed behind the respective sections 45A and 45B to block return movement of the plate 12 if the change key should be inadvertently turned.

Turning now to Figures 7 to 9, these show another embodiment of the invention, in the form of a safe deposit box lock. As is usual with locks provided for this purpose, two separate keys are required for unlocking, one of which, which we shall refer to as the "client key", is held by the renter of the corresponding safe deposit box and the other of which, which we shall refer to as the "custodian key", is held by the bank or other organisation which administers the renting of the boxes.

The bolt assembly of this lock is in two parts, one comprising a head 50 secured to a plate 51 which reciprocates in the forward part of the lockcase, and the other comprising a plate 52 which reciprocates immediately behind the plate 51. In order to withdraw the bolt head 50

from the illustrated thrown position plate 52 must first be shifted to the right followed by corresponding movement of the plate 51. Plate 52 is normally deadlocked by two packs of rotary tumblers 53A and 53B which block the paths of respective stumps 54A and 54B upstanding from the plate. The rotors 53A,53B, which are borne on pins 55A,55B and provided with notches 56A,56B, are equivalent to the rotors 10A,10B previously described, and have gear teeth 57A,57B in mesh with corresponding teeth 58A,58B on respective members of two packs of levers 59A and 59B. These levers are pivoted on respective pins 60A,60B and biased to their illustrated rest positions by respective springs 61A,61B. To withdraw the plate 52 a double-bitted client key is inserted from the near side of the lock and turned on a fixed pin 62 in the clockwise direction. The levers 61A,61B are accordingly lifted to turn the rotors 53A,53B into the positions in which their notches 56A,56B align with the stumps 54A,54B, and a bolt step on the key engages a talon face 63 on the plate (Figure 8) to shift the plate rightwards and bring the stumps 54A,54B into the notches 56A,56B. When the plate 52 reaches the limit of its travel the key is stopped by its engagement with face 63, and retained in the lock.

The bolt 50/51 is normally deadlocked by a further pack of rotors 53C again equivalent to elements 10A and 10B which block the path of a stump 54C upstanding from the plate, these rotors being borne on a pin 55C and provided with notches 56C. They have gear teeth 57C in mesh with corresponding teeth 58C on a further pack of levers 59C, the latter being pivoted on a pin 60C and biased to their illustrated rest positions by springs 61C. To withdraw the plate 51, plate 52 having already been withdrawn, a single-bitted custodian key is inserted from the near side of the lock and turned on a fixed pin 64 in the clockwise direction. The levers 61C are accordingly lifted to turn

the rotors 53C into the positions in which their notches 56C align with the stump 54C, and a bolt step on the key engages a talon face 65 on the plate (Figure 8) to shift the plate rightwards and bring the stump 54C into the notches 56C. The face 65 is cut away as shown in Figure 8 to release the key bit after the plate has been shifted, so that the custodian key can be removed from the lock after having turned through 180°, the custodian keyhole in the lock cover plate (not shown) being appropriately shaped to permit this.

To rethrow the bolt, the custodian key is inserted in the lock in the position whence it was removed, and turned anticlockwise through 180°. Its bolt step engages a talon face 66 on the plate 51 (Figure 8) to shift the bolt leftwards, and when the key finally releases the levers 59C they return to their rest positions under the bias of springs 61C and misalign the rotors 53C to deadlock the plate. The retained client key can now be turned back anticlockwise to its insertion position, in so doing its bolt step engaging a talon face 67 on the plate 52 (Figure 8) to shift that plate leftwards, and when the key finally releases the levers 59A,59B they return to their rest positions under the bias of springs 61A,61B and misalign the rotors 53A,53B to deadlock the plate.

It will be appreciated that when the custodian key has been used to withdraw the bolt 50/51 its rotors 53C are left in their aligned positions with the stump 54C received in the notches 56C, and the levers 59C are accordingly left in their lifted positions by virtue of the gear connection 57C/58C, even though the custodian key is removed. In the absence of further restraint on the plate 51 it would be possible for the client key to throw the whole of the bolt

assembly 50/51/52 from this condition without first using the custodian key as indicated above, and in some embodiments this function may indeed be provided. However, in the illustrated embodiment this is prevented by use of an additional, gated lever 68 (Figure 8) pivoted on the pin 60C and biased by a spring 69. When the plate 51 is withdrawn by the custodian key, a short stump 70 on the plate is moved from the pocket 71A of the lever in which it is shown in Figure 8, to the other pocket 71B. When the custodian key releases the lever 68 after withdrawing the bolt that lever is free to drop under the bias of its spring 69 to lock the stump 70 in the pocket 71A and thereby block throwing movement of the bolt, even though the other levers 59C are held in their lifted positions. This is, of course, because the lever 68 has no gear connection with a rotor 53C.

This lock can be reprogrammed to pass both new client keys and new custodian keys. As before the reprogramming process involves the disengagement of the rotors 53A and 53B from the levers 59A and 59B (in the case of the client key) or the disengagement of the rotors 53C from the levers 59C (in the case of the custodian key) and subsequent re-engagement in different relative rotational positions.

Dealing first with reprogramming for a new client key, it is seen from Figure 9 that the rotor pivot pins 55A and 55B are carried by a reciprocable plate 72. This plate is normally locked in its illustrated position by means of a stump 73 on the plate engaging in the slot 74 of a lever 75 pivoted on a fixed pin 76 and biased by a spring 77. The plate 72 can, however, be freed and shifted to the left, to disengage the rotors 53A, 53B from the levers 59A, 59B, by means of a single-bitted change key inserted through a keyhole 78 from

the far side of the lock. The bolt assembly plate 52 is provided with a hole 79 (Figures 7 and 8) into which the leading portion of the change key intrudes to lock that plate in place during the reprogramming process and the pivot pin plate 72 has two talon surfaces 80,81 and a stop surface 82 for engagement by the change key bit.

The sequence of operations for resetting the relative rotational positions of the rotors 53A,53B and levers 59A,59B to pass a new client key is essentially the same as that described above in respect of the rotors and levers of the Figures 1-6 embodiment of the invention. Thus, starting from the thrown condition, the change key is inserted to interlock the plate 52; the existing client key is inserted and turned clockwise to lift the levers 59A,59B and align the rotors 53A,53B, without moving the plate 52; the change key is turned anticlockwise to lift the lever 75 and shift the plate 72 to the left so that the rotors 53A,53B disengage from the levers 59A,59B and the notches 56A,56B slide over the stumps 54A, 54B; the existing client key is turned back anticlockwise and removed; the new client key is inserted and turned clockwise to set the levers 59A,59B in corresponding new lifted positions; the change key is turned back clockwise and removed to shift the plate 72 rightwards and release the lever 75, thus withdrawing the notches 56A, 56B from the stumps 54A,54B, reengaging the rotors 53A,53B with the levers 59,59B in their new positions, and relocking the plate 72; and the new client key is turned back anticlockwise and removed to misalign the rotors 53A,53B and leave the plate 52 deadlocked.

The lock components 72-82 which are provided to enable reprogramming for new client keys are duplicated for reprogramming the rotors 53C to pass new custodian keys,

the corresponding components which are provided for the latter purpose being indicated by the reference numerals 72'-82' respectively. The sequence of reprogramming for a new custodian key equates for that described above in respect of a new client key and description will not therefore be repeated in this respect.

As in the case of the previously-described safe lock, additional abutments are provided for preventing return movement of the respective change keys during reprogramming, between removal of the previous operating key and insertion of the new one. In the case of the custodian key change mechanism this function is provided by the nose 83 of the lever 68 dropping behind a square section 84 at the base of the pin 55C to block return movement of the plate 72', and in the case of the client key change mechanism this function is provided by the nose 85 of an additional lever 86 pivoted on the pin 60B and biased by a spring 87, which drops behind a square section 88 at the base of the pin 55B to block return movement of the plate 72 (see Figure 8). This lever 86 also normally provides an additional block on the movement of the bolt plate 52 when thrown, by virtue of the corresponding bolt stump 89 and racking slot 90.

Various modifications can be made to the two locks described and illustrated herein. For example, the lock of Figures 1 to 3 can be modified for dual key operation, whereby it is required that two keys are used in succession (both turning on the same pin 19) to withdraw the bolt head 1. This involves splitting the bolt plate 2 into two parts which must be withdrawn in succession, with the two correct keys being provided with bolt steps at different positions so that each key can shift only that part of the plate to which it is assigned. The first-used key thus "deblocks" the lock

and the second key can then be used for throwing and withdrawing the headed bolt plate. This type of operation is useful eg in the case of a lock on the door of a bank vault, where a senior employee holding the first key deblocks the lock at the start of the day, other employees holding the second key can then use the lock during working hours, and the senior employee finally blocks the lock again at the end of the day. The two sets of rotors 10A and 10B can also be reprogrammed separately, by splitting the plate 12 into top and bottom halves and duplicating the change keyhole 31, lever 27 and the other associated key change components.

In the case of the safe deposit lock, the custodian and client locking mechanisms could be provided in a "parallel" arrangement instead of the "series" arrangement illustrated if desired, in which case both the custodian and client lever packs are arranged on the same pivot axes and operated in succession by respective keys inserted through the same keyhole, whose bits are arranged to align with only that pack of levers to which the respective key is assigned. It is also envisaged to replace or supplement the custodian key-locking mechanism with a remotely-controlled electrically-actuated mechanism.

CLAIMS

1. A change-key lock of which the key-recognition mechanism comprises a set of movable tumblers (10A,10B; 53A,53B,53C) and a set of movable key-engaging elements (5A,5B; 59A,59B,59C) each one of which is normally in driving engagement with a respective said tumbler; the key-engaging elements and tumblers normally being biased to positions in which the tumblers block the retraction of a locking member (1/2;52,50/51) but the tumblers being drivable by the respective key-engaging elements to unlocking positions in which they permit such retraction, when the key-engaging elements are moved by a correct key (4); characterised in that the tumblers are borne relative to the key-engaging elements such that the tumblers can be withdrawn from such elements to break said driving engagement, only when the tumblers are in said unlocking positions, and said driving engagement can be re-established with the key-engaging elements in different relative positions to those in which said engagement was broken.

2. A lock according to claim 1 arranged such that in use the driving engagement between the tumblers (10A,10B; 53A,53B,53C) and key-engaging elements (5A,5B; 59A,59B,59C) is broken and re-established as aforesaid by operation of an auxiliary key (30) inserted into the lock.

3. A lock according to claim 2 wherein the tumblers (10A,10B; 53A,53B,53C) are carried on a movable member (12;72,72') which is normally locked against movement by an auxiliary tumbler member (27;75,75') and said auxiliary key (30) has a bit (34) adapted to move the auxiliary tumbler member to an unlocking position and to shift the movable member to withdraw the tumblers as aforesaid upon rotation of the auxiliary key in the lock.

4. A lock according to claim 2 or claim 3 wherein the auxiliary key (3C) has a portion (32) adapted to engage the locking member (1/2; 52,50/51) to prevent movement of the latter during the operation of the auxiliary key in the lock.

5. A lock according to any preceding claim wherein said tumblers (10A,10B; 53A,53B,53C) are adapted to abut the locking member (1/2; 52,50/51) to block withdrawal of the tumblers from the key-engaging elements (5A,5B; 59A,59B,59C) when the locking member is in its retracted position.

6. A lock according to any preceding claim wherein the key-engaging elements (5A,5B; 59A,59B,59C) comprise pivoted levers and the tumblers (10A,10B; 53A,53B,53C) are borne for rotation, the driving engagement between respective levers and tumblers being established by intermeshing gear teeth on said levers and tumblers.

7. A lock according to claim 6 wherein the tumblers (10A,10B; 53A,53B,53C) have respective radial notches (13A,13B; 56A,56B,56C) which align with a stump (3A,3B; 54A,54B,54C) on the locking member (1/2; 52, 50/51) when the tumblers are in said unlocking positions; and wherein said notches embrace said stump to prevent rotary movement of the respective tumblers when the tumblers are withdrawn as aforesaid.

8. A lock according to any preceding claim wherein there are two separate sets of said tumblers (10A,10B) and key-engaging elements (5A,5B), both said sets being adapted to block the retraction of a common locking member (1/2) and being operable in unison by a common correct key (4); and wherein the tumblers of both said sets are arranged to be withdrawn in unison from the respective key-engaging elements..

9. A lock according to any one of claims 1 to 7 wherein the locking member comprises a bolt formed in two separate portions a first (52) of which must be retracted prior to retraction of the second (50/51); there are two separate sets of said tumblers (53A/53B;53C) and key-engaging elements (59A/59B;59C), each of said sets being adapted to block the retraction of a respective one of said portions and being operable independently of the other set by a separate correct key; and wherein the tumblers of each of said sets are arranged to be withdrawn from the respective key-engaging elements independently of the other set.

Fig.1.

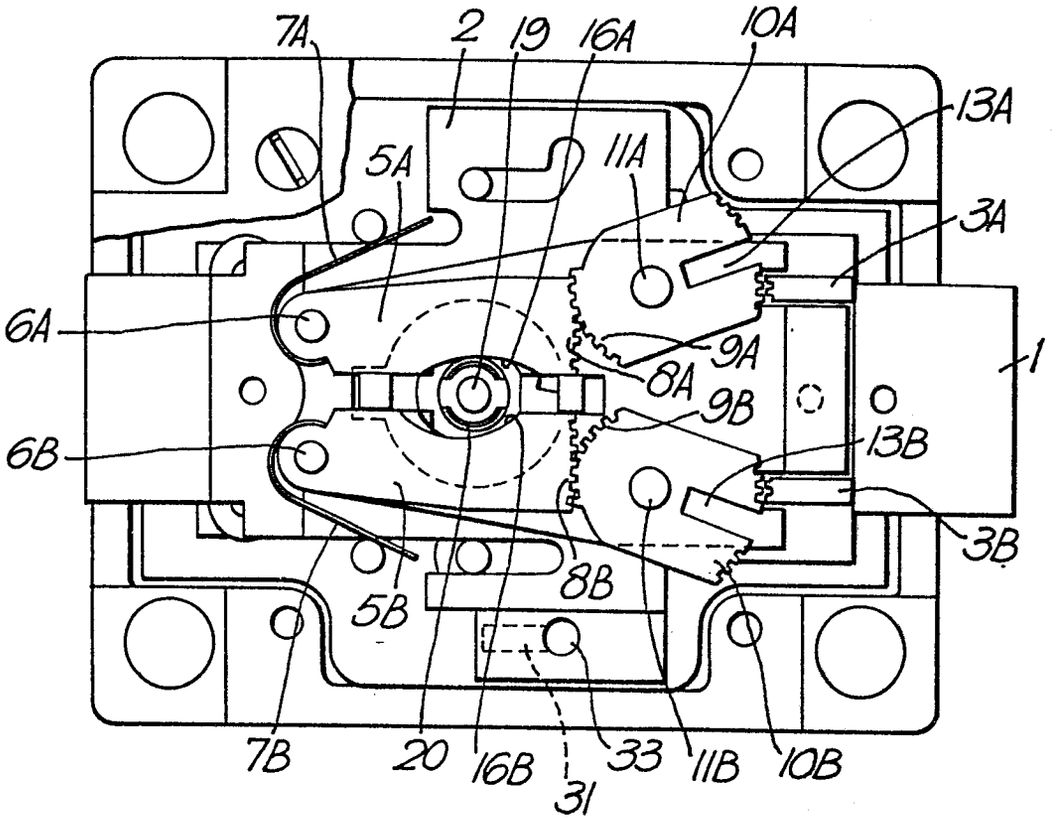

7A
2
19
16A
10A
13A
5A
11A
3A
6A
9A
8A
9B
1
6B
13B
3B
8B
5B
7B
20
16B
33
11B
10B
31

Fig.2.

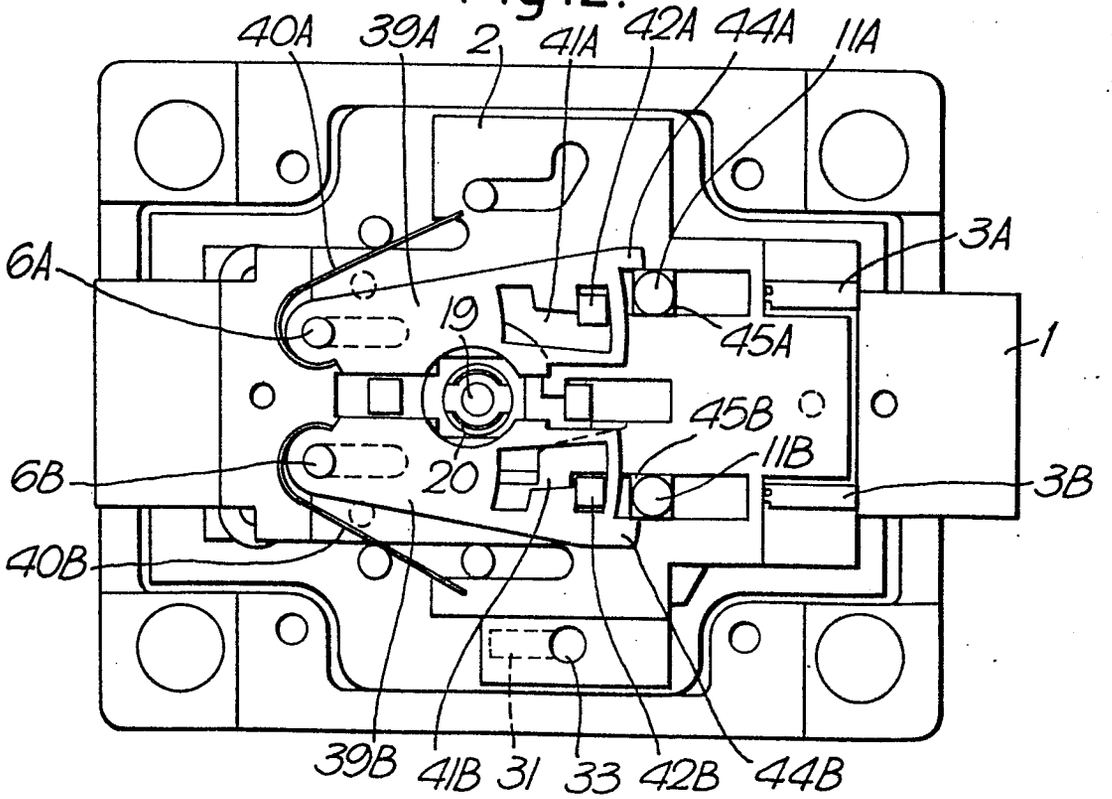

40A
39A
2
41A
42A
44A
11A
3A
6A
19
45A
1
45B
11B
6B
20
3B
40B
39B
41B
31
33
42B
44B

Fig.3.

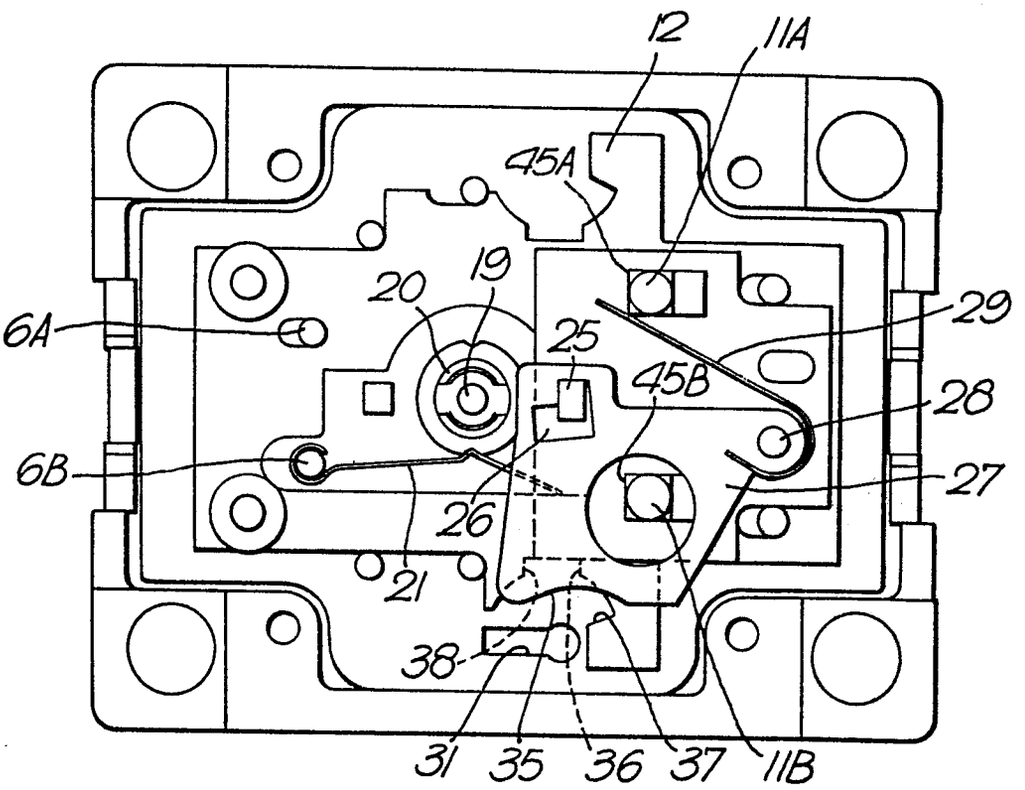

12
11A
45A
20
19
6A
25
29
45B
28
6B
27
26
21
38
31
35
36
37
11B

Fig.4.

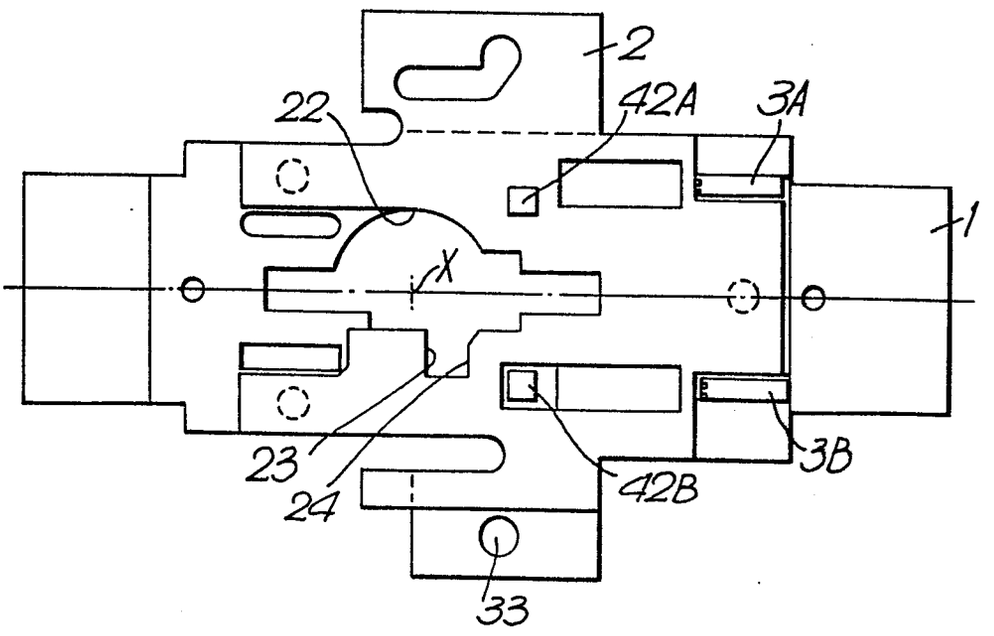

2
22
42A
3A
1
X
23
24
42B
3B
33

Fig.5.

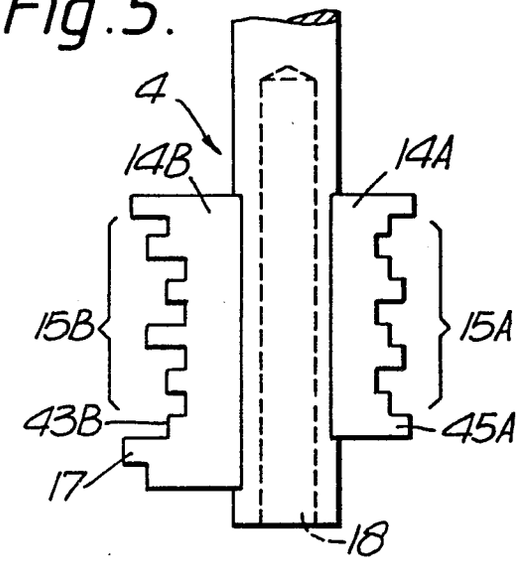


Fig.6.

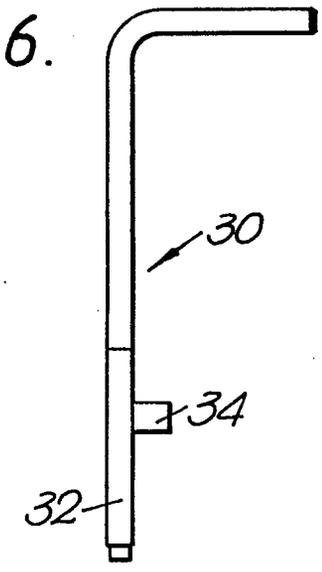
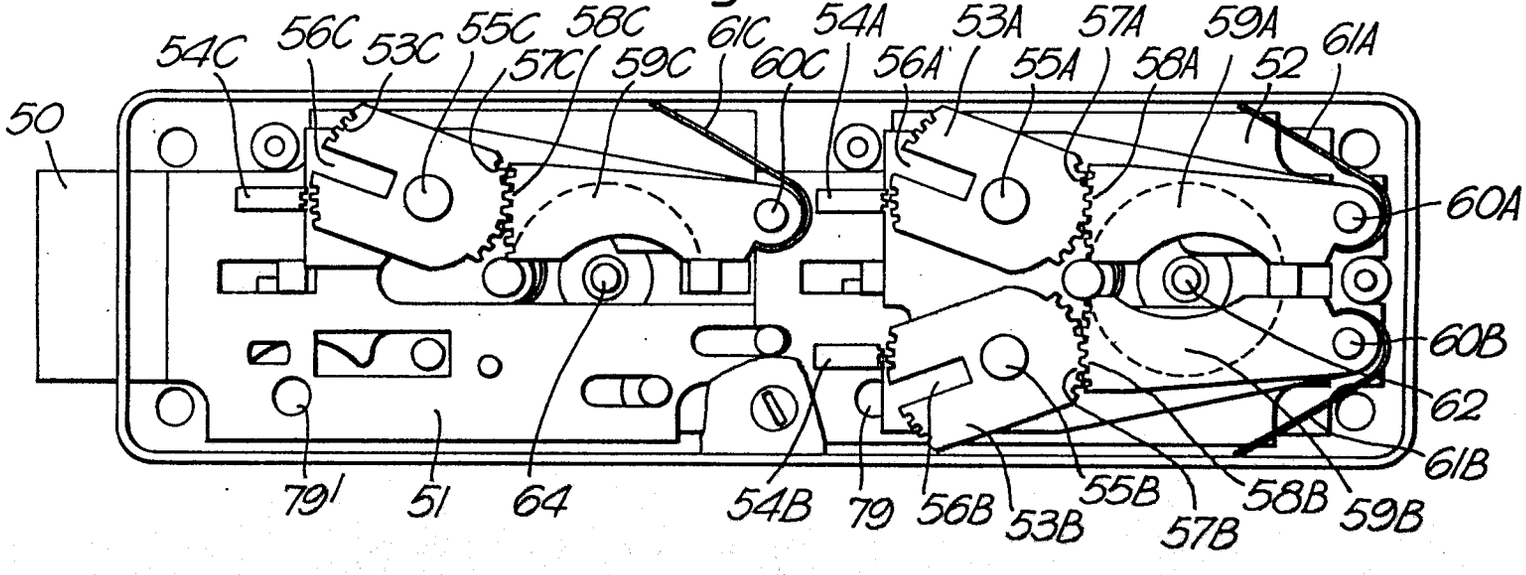


Fig.7.



0111363

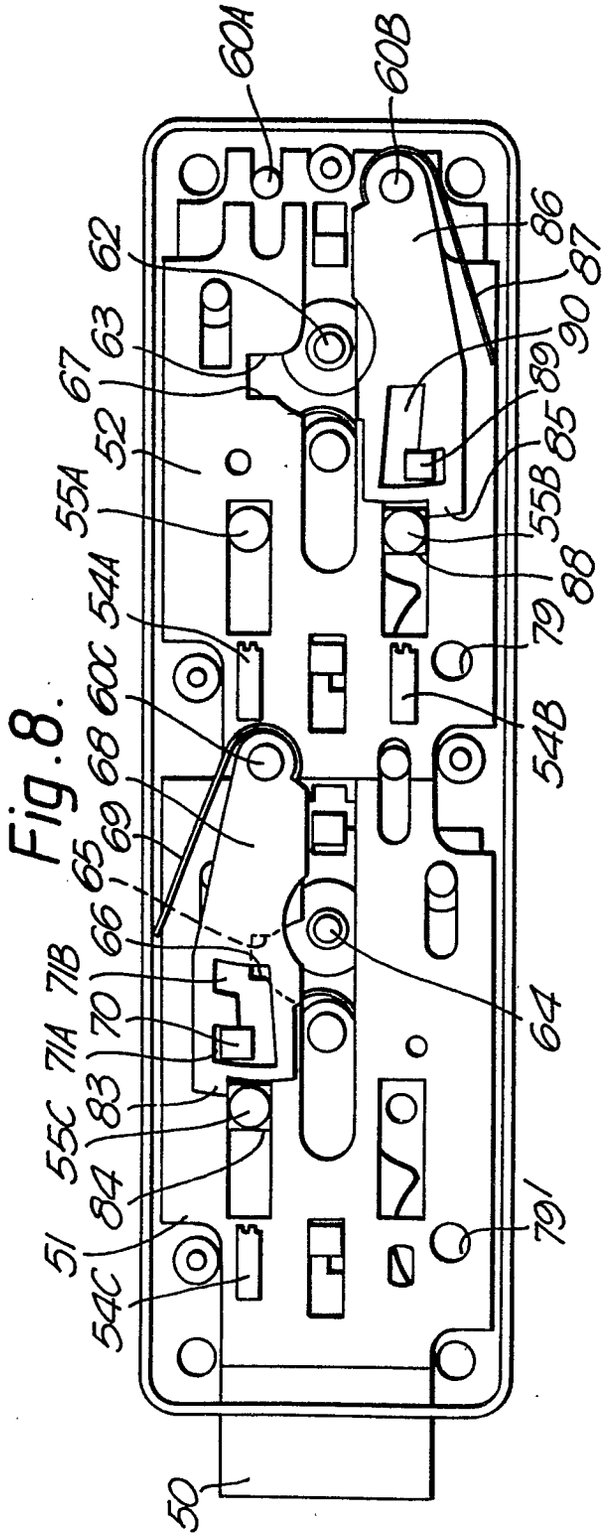

604
608
62
63
67
52
55A
54A
60C
68
69
65
66
71B
70
71A
55C
83
84
51
54C
50
86
87
90
89
85
55B
88
79
54B
64
79'

Fig. 8.

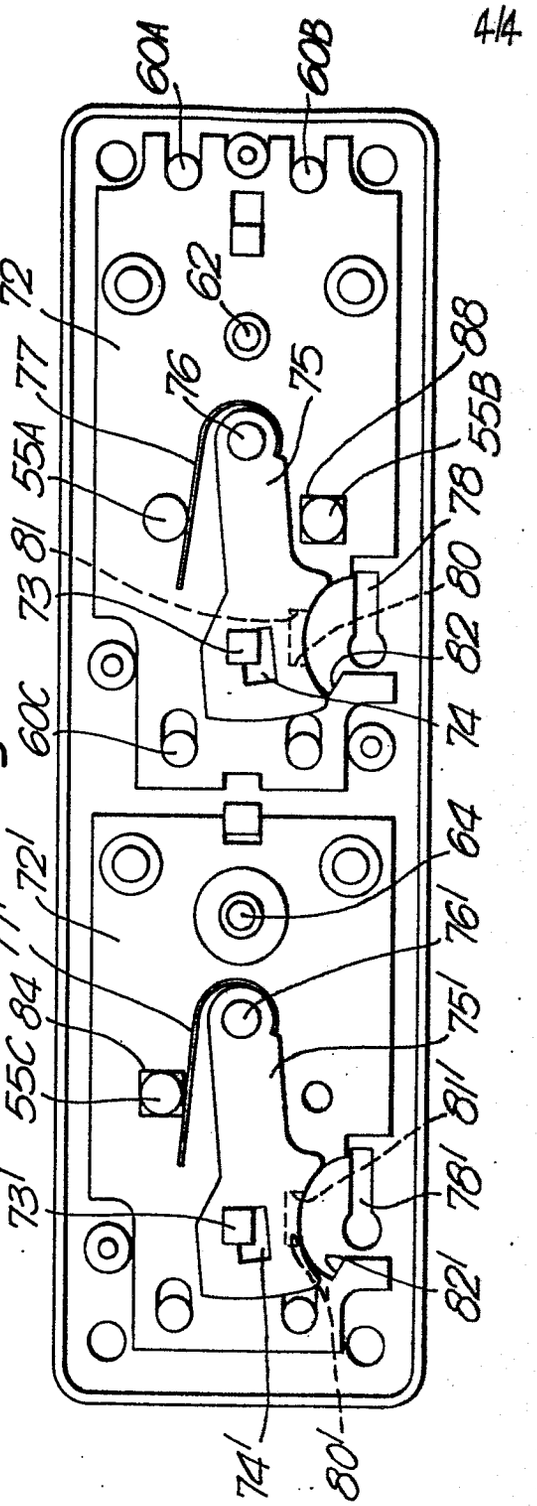

604
608
72
62
77
76
75
88
55A
55B
73
81
78
80
82
74
60C
72'
64
77'
76'
84
75'
55C
73'
81'
78'
82'
74'
80'

Fig. 9.