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(11) Publication number:

**0 672 808 A1**

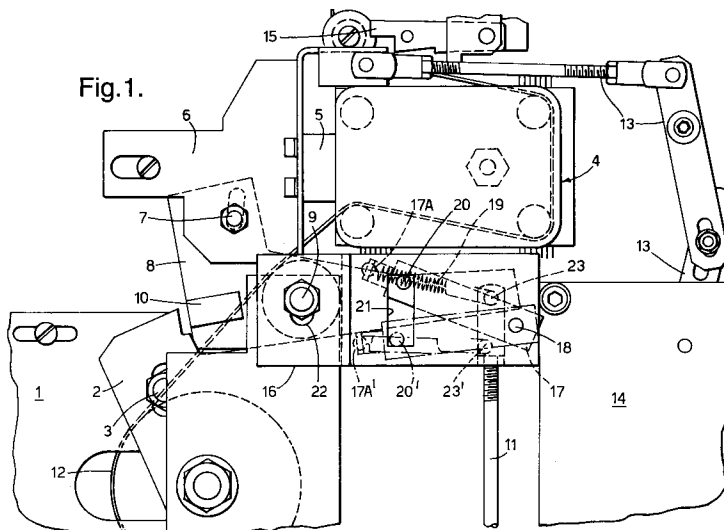
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**EUROPEAN PATENT APPLICATION**(21) Application number: **95200564.3**(51) Int. Cl.<sup>6</sup>: **E05B 65/00, E05B 15/00**(22) Date of filing: **08.03.95**(30) Priority: **17.03.94 GB 9405218**(43) Date of publication of application:  
**20.09.95 Bulletin 95/38**(84) Designated Contracting States:  
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**Hampshire GU13 8BU (GB)**(54) **Door locking mechanisms for security enclosures.**

(57) A locking mechanism for the door of a safe or the like has a bolt strap (1) operated by a thrower (2) and a keyless combination lock (4) whose bolt (5) pivots a lever (8) to block retraction of the strap (1) and thrower (2). The lever (8) is also connected through a rod (11) to a shutter for blocking the entrance to a separate key lock (not shown). In order to relieve the force acting inwards on the bolt (5)

when it is thrown there is provided a spring (19) connected at one end (23) to the lever (8) and at its other end (17A) to another pivoted lever (17), the arrangement being such that the spring (19) goes overcentre to apply a force to the bolt (5) in the same sense as its throwing movement whenever the latter is thrown.

Fig.1.

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The present invention relates to safes, vaults, strongrooms and the like security enclosures, and more particularly to locking mechanisms for the doors of such enclosures.

It is customary for the door of a safe or the like to be locked by means of bolts thrown from one or more edges of the door into engagement with the surrounding frame, for which purpose there is provided an externally-accessible handle, wheel or the like operating member which drives the boltwork through a mechanical transmission mounted within the door, the same mechanism, of course, being used to withdraw the bolts when the door is to be opened. This boltwork is in turn locked in its thrown condition by the operation of one or more locks which throw their own bolts, or other abutments linked to their bolts, into blocking positions in relation to the main boltwork or its transmission to resist subsequent retraction of the main bolts under forcing loads. These locks may be (mechanical) key-operated locks or keyless combination locks, or electromechanical locks operated e.g. through an electronic keypad or other form of code input. In the common case where the mechanism includes both a key-operated lock and keyless combination lock it is also known for the combination lock bolt to operate a shutter for blocking the entrance for the key to the keylock.

A "keyless combination lock" as referred to herein is a lock of the well-known kind comprising a plurality of gated tumbler wheels which can be set to unlocking positions, by appropriate manipulation of an associated dial, to receive the probe or "fence" of a drop-arm (or "fence lever") linked to the bolt. The drop-arm is usually held up by the misaligned tumbler wheels and faces an abutment in the lockcase to prevent forced retraction of the bolt. When the tumbler wheels are properly aligned, however, the drop-arm is freed to fall and can be engaged by a cam driven by the dial spindle to withdraw the bolt. The same cam is used to extend the bolt and throw out the drop-arm when locking, the tumbler wheels then being scrambled to ensure that the drop-arm must remain in the locking position until the correct unlocking combination is set. Keyless combination locks are shown for example in US-3968667, US-4628715 and GB-815654.

When keyless combination locks are used in a safe or the like locking mechanism, particularly when used to move heavy or stiff abutments or shutters linked to the lock bolt, the bolt can be subjected to significant end loads acting inwardly against it; (we are speaking here of loads experienced in normal operation of the lock - not just in the extreme case of an attack upon the enclosure). These loads are easily overcome by the cam when being turned by the dial to throw out the bolt, but

they can cause problems, such as jamming of the tumbler wheels and drop-arm when the bolt has been thrown out and the cam disengaged, (thereby preventing the tumblers from being scrambled to render the lock secure or preventing the drop-arm from falling during the next opening procedure, causing a lock-out), and premature wearing of these parts. The present invention seeks to overcome these problems, by relieving the force acting inwards on the bolt in such circumstances. However, while described specifically in terms of keyless combination locks, the invention may also find utility in conjunction with keylocks or other forms of lock where similar problems may arise.

In one aspect the present invention accordingly resides in a locking mechanism for the door of a security enclosure, comprising: boltwork; a mechanical transmission for throwing and withdrawing the boltwork in response to corresponding operation of an externally-accessible operating member; at least one lock having a reciprocable bolt for performing a security function in relation to the mechanism when said bolt is thrown; and spring means linked to said bolt in such a manner that when the bolt is thrown an overcentre condition is reached in which the spring means applies a force to the bolt in the same sense as its throwing movement. In this way, when (but only when) the bolt is thrown the aforesaid spring means applies a force to the bolt which opposes any forces from the rest of the mechanism which may tend to load the bolt inwards and alleviates the problems which may be associated with the latter.

Preferably, when the bolt is withdrawn the same spring means applies a force to the bolt in the same sense as its withdrawing movement. This is helpful in the event that there would otherwise be a force on the bolt in the throwing direction when it is withdrawn, which would require the bolt to be held in by hand while the main boltwork is withdrawn.

In a preferred embodiment the bolt of said lock is linked to a first lever; the spring means comprises a tension spring one end of which is attached to said lever; the other end of said spring is attached to a second lever borne for pivotal movement between two stops; and the pivot points of said levers and their attachment points to the spring are so disposed that when the bolt is in its withdrawn position the second lever lies against one of said stops under the force of the spring which is also applied to the first lever in the sense tending to withdraw the bolt, but when the bolt is moved to its thrown position the corresponding movement of the first lever causes the spring to pivot the second lever to lie against the other said stop in which position the force of the spring is applied to the first lever in the sense tending to

throw the bolt. In other words, whenever the bolt is thrown or withdrawn the spring is caused to go overcentre and effectively reverses its biasing force upon the first lever and bolt.

The invention also resides *per se* in a device adapted to be retrofitted to an existing locking mechanism for the purpose described above, comprising spring means and an associated mounting member and lever.

The invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 illustrates part of one example of a locking mechanism within the door of a safe or the like modified in accordance with the invention;

Figure 2 shows part of the modified mechanism of Figure 1; and

Figure 3 shows in section the device which modifies the mechanism in accordance with the invention.

Referring to Figure 1, which shows the mechanism as viewed from the inside face of the safe door, in the locking position and with a cover plate removed, the illustrated mechanism comprises a horizontally reciprocable bolt strap 1 carrying main door bolts (not shown) which are thrown and withdrawn from the opening side edge of the door into corresponding detentions (not shown) in the body of the safe. For throwing and withdrawing the door bolts there is a handle (not shown) on the outside of the door connected by a shaft to a thrower 2 which drives the bolt strap 1 through a pin-and-slot coupling 3.

For locking the boltwork in its thrown condition there is a keylock (not shown) and a keyless combination lock 4, both of known kind. The bolt 5 of the combination lock is connected via a plate 6 and pin-and-slot coupling 7 to a lever 8 pivoted at 9. The lever 8 carries a block 10 which is moved to lie behind the boltstrap 1 and in the path of the thrower 2 when thrown, thereby to resist forced retraction of the door bolts and to prevent force being applied to the boltstrap from the external handle. The lever 8 is also connected through a rod 11 to a shutter (not shown) which, after operation of the keylock, serves to block its key entrance or to retain a filler piece in that entrance, in a manner known *per se*, when the combination lock is operated. The keylock itself moves an additional block (not shown) behind the boltstrap 1 also to resist forced retraction of the door bolts, when its arm bolt is thrown.

The illustrated mechanism also comprises a so-called relocker comprising a wire 12 guided to pass across vital points of the mechanism and connected at each end to spring-biased bolts (not shown). In the event that the wire 12 is broken or

dislodged in an attack upon the door its tension is relieved allowing the relocker bolts to shoot into in which they provide two additional blocking points against forced retraction of the door bolts.

In addition, the combination lock bolt 5 is connected through an articulated linkage 13 to a unit 14 for arming and disarming an associated alarm system. There is also a time-delay unit (not shown) including a solenoid-operated lever 15 for blocking retraction of the combination lock bolt 5 if timed locking of the door is required.

It will be appreciated that, in the locking condition of the illustrated mechanism, the combination lock 4 may be subject to loads acting inwards upon its bolt 5 from other parts of the mechanism. In particular the weight of the shutter on rod 11 acting through the lever 8 will apply a constant inward load and, as previously discussed, this can lead to problems with the operation of, and accelerated wear within, that lock. We therefore consider it desirable to relieve these loads by the application of a force acting in the throwing direction of that bolt. At the same time, however, it is undesirable to apply such a force in the withdrawn condition of the bolt 5 and in that condition any net force upon the bolt should act in the withdrawing direction. To meet these concerns, in accordance with the invention an additional overcentre spring device is included in the mechanism as will now be described also with reference to Figures 2 and 3.

The additional mechanism comprises a mounting plate 16 to which one end of a lever 17 is pivoted at 18. To the other end of the lever 17, at 17A, is attached one end of a tension coil spring 19. Towards the same end as the attachment point for the spring 19 the lever 17 also carries a pin 20 which runs in a slot 21 in the plate 16, the ends of the slot defining the limits of the permitted pivotal movement of the lever. In use, this device is mounted in the door by fixing the plate 16 over the pivot post 9 for the lever 8, a mounting slot 22 being provided in the plate 16 for this purpose. In addition, the free end of the spring 19 is attached to the end of the lever 8 at 23 where it connects with the rod 11.

In the condition of the device shown in Figure 2, which corresponds to the locking condition of the overall mechanism as shown in Figure 1, the point of connection 23 between the spring 19 and lever 8 lies above the pivot point 18 for the lever 17 and the latter is accordingly raised by the spring tension until its pin 20 is stopped by the upper end of the slot 21. In this condition the line of action of the spring 19 passes above the pivot point 9 for the lever 8 and the spring tension accordingly acts upon the lever 8 in the sense to urge the lever anticlockwise (as viewed). The lever 8 accordingly applies a force to the combination lock bolt 5 in the

sense tending to extend that bolt. The strength of the spring 19 can be chosen so that this force significantly reduces or eliminates the force which otherwise would act on that bolt in the withdrawing direction.

When the mechanism is subsequently unlocked and the combination lock bolt 5 is withdrawn, the bolt pivots the lever 8 clockwise (as viewed) so that its point of connection with the spring 19 is now below the pivot point 18 for the lever 17, as indicated at 23<sup>1</sup> in Figure 1. The lever 17 is accordingly now pulled down by the spring tension until its pin 20 is stopped by the lower end of the slot 21, (as indicated at 20<sup>1</sup> in Figure 1). In this condition the line of action of the spring passes below the pivot point 9 for the lever 8 and the spring tension accordingly acts upon the lever 8 in the sense to urge it clockwise (as viewed), therefore applying a force to the lock bolt 5 in the withdrawing direction.

Subsequent locking of the mechanism and throwing of the combination lock bolt 5 causes the lever 17 to switch back again to its upper position. In effect, whenever the bolt 5 is thrown or withdrawn the direction of the force of the spring 19 acting on that bolt through the lever 8 is reversed, the point of reversal occurring as the spring goes overcentre - that is to say as the connection point 23 passes through the line between the pivot 33 and the connection point 17A, in either direction. The actual point in the movement of lever 8 at which this reversal takes place can be adjusted somewhat by raising or lowering the mounting plate 16 within limits set by the slot 22.

## Claims

1. A locking mechanism for the door of a security enclosure, comprising: boltwork; a mechanical transmission (1,2) for throwing and withdrawing the boltwork in response to corresponding operation of an externally-accessible operating member; and at least one lock (4) having a reciprocable bolt (5) for performing a security function in relation to the mechanism when said bolt (5) is thrown; characterised by spring means (19) linked to said bolt (5) in such a manner that when the bolt (5) is thrown an overcentre condition is reached in which the spring means (19) applies a force to the bolt (5) in the same sense as its throwing movement.
2. A mechanism according to claim 1 in which when said bolt (5) is withdrawn said spring means (19) applies a force to the bolt (5) in the same sense as its withdrawing movement.

3. A mechanism according to claim 2 wherein said bolt (5) is linked to a first lever (8); the spring means comprises a tension spring (19) one end (23) of which is attached to said lever (8); the other end (17A) of said spring (19) is attached to a second lever (17) borne for pivotal movement between two stops (21); and the pivot points (7,18) of said levers (8,17) and their attachment points (23,17A) to the spring (19) are so disposed that when the bolt (5) is in its withdrawn position the second lever (17) lies against one of said stops (21) under the force of the spring (19) which is also applied to the first lever (8) in the sense tending to withdraw the bolt (5), but when the bolt (5) is moved to its thrown position the corresponding movement of the first lever (8) causes the spring (19) to pivot the second lever (17) to lie against the other said stop (21) in which position the force of the spring (19) is applied to the first lever (8) in the sense tending to throw the bolt (5).
4. A device adapted to be fitted to the locking mechanism of the door of a security enclosure in order to apply a spring force to the bolt (5) of a lock (4) comprised in the mechanism, characterized by a mounting member (16), a lever (17) borne at one end (18) by the mounting member (16) for pivotal movement between two stops (21), and a tension spring (19) attached at one end to the other end (17A) of said lever, the other end (23) of said spring being adapted to be linked to said bolt (5) so that when the bolt (5) is thrown an overcentre condition is reached in which the spring (19) applies a force to the bolt (5) in the same sense its throwing movement.

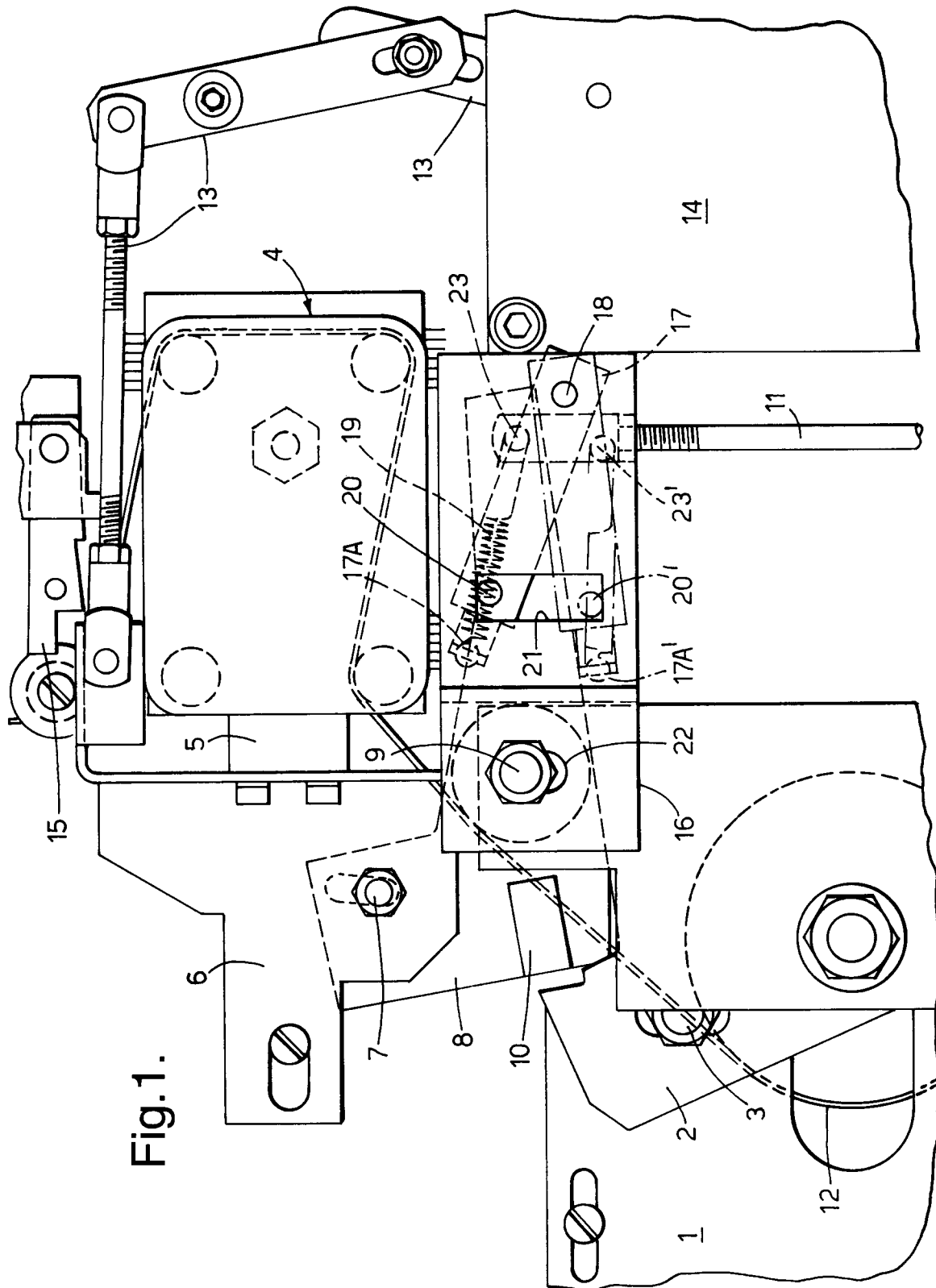


Fig.2.

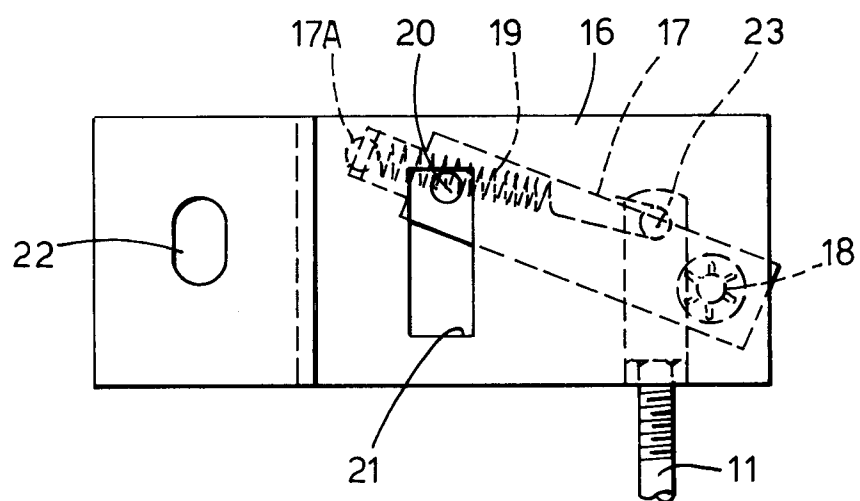
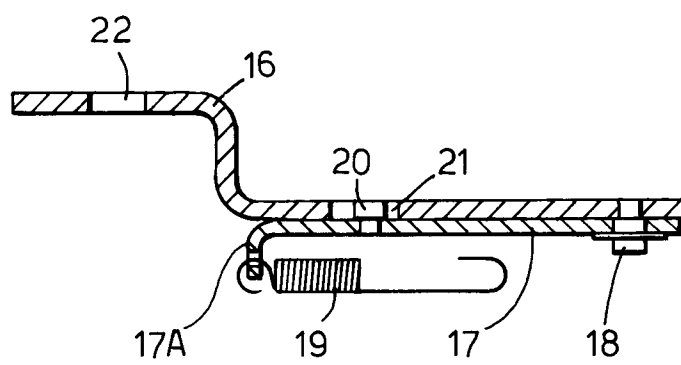


Fig.3.





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## EUROPEAN SEARCH REPORT

Application Number  
EP 95 20 0564

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-5 267 460 (BURLEIGH) 7 December 1993 * abstract; claims; figures 1,5 *	1,2	E05B65/00 E05B15/00
Y	---	3,4	
Y	GB-A-2 008 661 (CHUBB & SON'S LOCK & SAFE CO. LTD.) 6 June 1979 * abstract; figures *	3,4	
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D,A	US-A-3 968 667 (GARTNER ET AL.) 13 July 1976		
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D,A	US-A-4 628 715 (UYEDA ET AL.) 16 December 1986		
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D,A	GB-A-815 654 (CHUBB & SON'S LOCK & SAFE CO. LTD.) 1 July 1959 -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27 June 1995	Examiner Soederberg, J
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	