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"Improvements in or relating to a tumbler lock".

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The present invention relates to disc tumbler locks to enable such locks to be useful and approved by authorities for use with security doors or in other architectural applications.

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Conventionally pin tumbler locks have been used in architectural situations. One of the reasons for this is that pin tumbler locks can have significantly greater strength than disc tumbler locks primarily due to the greater shear strength of the pins interfering between the lock cylinder and its housing in the locked position. Consequently it has mainly been pin tumbler locks that have managed to receive approval from certain authorities for use in security applications and particularly for so-called "security" screen doors in architectural situations. However, it is possible to produce disc tumbler locks at substantially less expense than pin tumbler locks and in addition to achieving satisfactory strength performance provide a greater range of desirable functions within the one mechanism.

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The objective of the present invention is to provide a disc tumbler lock which has both adequate torsional strength and a fail safe characteristic, should it be forced, making it suitable for architectural situations and in particular security door applications.

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Moreover, in conventional security screen doors with dead locking facilities, it is necessary to use a key from both inside and outside to operate the door correctly. This, however, is sometimes inconvenient, particularly where a person may wish to go in and out through the door numerous times during a day. As a result such doors are often left unlocked thereby defeating the purpose of the door. It is therefore a preferred objective of one embodiment of the present invention to provide a lock which may be externally dead locked but which may be internally operated by a manual latch member to allow exit and entry through the door. It is a further preferred objective of the above embodiment to additionally provide the lock with the capability of being dead locked by internal operation of the key.

A further difficulty with security screen doors is that in most instances they have one point locking which allows the upper and lower free corners to be levered away from the surrounding frame to permit access through the door.

5 Accordingly it is a further preferred objective of another embodiment of the present invention to provide a lock of the aforementioned kind adapted for use with simple linkage means permitting economic three point locking of a security door.

10 In accordance with the present invention there is provided a disc tumbler lock mechanism comprising a lock cylinder with a key slot and disc elements adapted for co-operation with a key inserted in said key slot, a housing surrounding said cylinder having recesses co-operable with
15 said disc elements, and an actuating element adapted to be driven in response to movement of said lock cylinder, said lock being characterized by a blocking member having a first portion restrained for movement with the lock cylinder, a second portion selectively restrained in a first position by
20 said housing but movable out of said first position by insertion of the key into said key slot, and a third portion adapted to drive said actuating element.

Preferably the blocking member may be produced with sufficient shear strength to ensure the torsional strength of the lock is adequate to prevent the lock mechanism being
25 opened by torsional forcing. When a lock is being forced by torsional strain the objective is to shear the lock blocking elements, in this instance, the disc elements and the blocking member thereby enabling the lock cylinder to turn with consequent movement of the actuating elements of the lock. However,
30 fail safe operation is possible by providing a blocking member of adequate strength whereby the lock cylinder will fail before the blocking member such that even under this condition the cylinder cannot be rotated.

According to a first preferred embodiment, the blocking
35 member is located within a slot formed in the lock cylinder which might be part of the key slot. Moreover the slot receiving said first portion might be widened to accomm-

update greater widths of the blocking member to increase its shear strength. The second portion of the blocking member in said first position is preferably received within a recess in said housing, but is moved out of said recess when a key is inserted into the key slot without disengaging the first portion from the slot in the lock cylinder. Conveniently the third portion of said blocking member is received within an arcuate slot within said actuating element, said third portion engaging with the ends of said arcuate slot to drive said actuating element.

In a second practical embodiment the blocking member is formed as a generally L shaped member with one leg thereof received in sliding relation within a diametral slot passing through the lock cylinder. The said one leg includes a key access hole to permit the passage of the key through the cylinder and to thereby activate or move the blocking member from the first position to the second position. The free end of the said one leg of the blocking member is adapted to form the third portion thereof and is received within a groove in the actuating element adjacent an end of the groove. When the key is inserted into the lock cylinder and rotated, the free end of said one leg engages with the end of the groove in the actuating element to move the actuating element as desired. The second leg of the blocking member forms the second portion thereof and is engageable within a recess in the housing in the first position but being freed therefrom by insertion of the key with the consequent movement of the blocking member. A spring element is provided to urge the blocking member towards the first position.

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings. In the drawings:

Figure 1 is a partially sectioned view of a first embodiment of a lock produced according to the present invention;

Figure 2 is a section view taken along line X - X of Figure 1;

Figure 3 is a view similar to Figure 1 but with a key inserted into the lock;

Figure 4 is a section view taken along line Y -- Y of Figure 3;

5 Figure 5 is a partial section view similar to Figure 1 with the key cylinder rotated through 180° ;

Figure 6 is a section view taken along line A -- A of Figure 5;

10 Figure 7 is a view similar to Figure 5 with the key shown inserted in the reverse direction;

Figure 8 is a side elevation view, partly sectioned, of a second embodiment according to the present invention;

Figure 9 is a section view taken along line B - B of Figure 8;

15 Figure 10 is a view similar to Figure 8 with the key inserted;

Figure 11 is a section view taken along line D - D of Figure 10;

20 Figure 12 is a perspective view of the lock cylinder of Figures 8 to 11; and

Figure 13 is a perspective view of the blocking member of Figures 8 to 12.

Referring to Figure 1 there is shown a disc tumbler lock cylinder arranged within a lock cylinder housing 11. 25 The lock cylinder 10 includes a plurality of disc elements 12 traversing a key receiving slot 15, the disc elements 12 being of conventional design adapted for co-operation with both a key 13 (Figure 3) and with splines or recesses 14 in the housing whereby the cylinder is locked to the housing 30 when the key is removed and the cylinder is free to rotate within the housing when the key is correctly inserted. These elements may be in accordance with any known type of disc tumbler lock and consequently will not be described in any significant detail. In the embodiment illustrated the key 35 13 is symmetrical about its longitudinal axis which permits it to be inserted in either of two orientations as opposed to pin tumbler lock keys where the key must always be inserted

in one orientation only. This provides substantial advantages for key operation in the dark and is characteristic of disc tumbler locks, however, it should be appreciated that this symmetrical arrangement is not an essential element of such locks in this invention.

The lock cylinder 10 extends beyond the housing 11 and is received within a latch actuating member 16 which is intended to be placed internally for manual operation of the lock as will be hereinafter explained. Furthermore, it will be appreciated that the key slot 15 extends through the cylinder so that the key 13 may be inserted from either inside or outside to operate the lock. A blocking or pawl member 17 is provided co-operating with all three of the lock cylinder 10, the lock housing 11 and the latch activating member 16. The pawl 17 is preferably a U-shaped element produced from a relatively strong hardwearing material such as steel. The base 18 of the U of the pawl 17 fits into and remains within a recess 19 in the lock cylinder 10. The recess 19 may form an extension of the key slot 16 and may be widened to accommodate the width of the pawl 17. The two legs of the U of the pawl 17 are each formed into substantially horizontal or laterally extending tab portions 20 and 21. The tab portion 20 co-operates with the housing 11 and in the locked position (Figure 1) is received within and retained by a recess 22 located within the housing. The second tab portion 21 is received within a slot 23 located in the latch actuating member 16 which extends arcuately about the lock axis of rotation. In the preferred embodiment (Figure 6), the slot 23 extends over 180°. It should, however, be appreciated that the length of the slot is purely a design choice which might be varied depending on required circumstances. In the locked position illustrated in Figure 1, the blocking pawl 17 is urged downwardly by suitable spring means. The spring means may be a leaf spring 24 (best seen in Figure 6) to hold the tab portion 20 in the housing recess 22 and the tab portion 21 in the slot 23. Alternatively a circumferential or part circumferential resilient element or spring such as a

quarter spring might be used.

The operation of the lock device will now be described with reference to the accompanying drawings. Starting with the lock in the locked position (Figure 1), a key 13 may be inserted into the key slot 15 from either the front or the rear. The key provided has a profile shape and symmetrical key lift means to provide this capability. As shown in Figures 3 and 4, correct insertion of the key 13 results in one of the key lift means 25 engaging the base 18 of the pawl 17 lifting it such that the tab portion 20 is disengaged from the housing recess 22 but leaving the base 18 still engaged within the recess 19 of the lock cylinder 10. In this position, the key 13 may be turned through 180° carrying with it the cylinder 10 and the pawl 17 such that the second tab portion 21 slides through the slot 23 in the direction of arrow A (Figure 6). This provides a lost motion movement, however, eventually the tab portion 21 engages with the end 26 of the slot 23 to also move the latch actuating member 16 from the locked position (Figures 1 to 4) to an open position. In the preferred embodiment illustrated, lost motion movement occurs for 180° of movement of the key in the direction A, however, a further 90° of key movement will result in active unlocking of the lock. To re-lock the door from the external side, the key simply returns along the opening path until the lock returns to the locked condition.

As is shown schematically in Figure 6, the latch actuating member 16 includes elements 27 adapted for connection to locking elements such as the locking arm 28 shown in phantom outline in Figure 6. The further 90° of movement of the key 13 is illustrated by the arrow B. For three point locking of a security door, two such locking arms may be provided extending upwardly and downwardly from the lock, for example, employing the actuating means disclosed in our Australian Patent No. 518869 with a laterally extending means for the third locking point. The present invention, however, is not restricted to such means as the lock could be equally applicable to one point locking operated from the latch actuat-

ing member 16.

Now, as indicated previously, it is desirable to provide a lock which may be locked externally but which is manually operable from the inside without the need to find a key each time exit and entry is required. The present lock provides this capability as will now be explained. Starting with the lock in the deadlocked condition (Figure 1), if the key 13 is inserted into the key slot 15 from the inside and rotated, for example to the position shown in Figure 7, the blocking pawl 17 is not restrained relative to the housing and the disc elements 12 are withdrawn within the cylinder 10. However, withdrawal of the key 13 (Figure 1) returns the lock to the condition shown in Figure 5 where the disc elements 12 lock the cylinder 10 to the housing 11. In consequence the lock is "locked" externally, however, internally the latch actuating member 16 may be rotated manually to open or close the locking elements (for example locking arm 28) with the slot 23 of the latch member 16 sliding over the pawl tab 21. To assist operation of the latch member 16 in this mode, the member is preferably provided with finger grips for ease of manual movement.

Now, in a third mode of operation, it may be desirable to use the lock during the day in the format described above with reference to Figure 5 but to provide a dead locking facility at night operable from the inside thereby avoiding the need to go outside to effect this dead locking mode of operation. The present lock provides this facility. For example, with the lock in the condition shown in Figure 5, it is possible to insert the key (Figure 7) from the inside and rotate the cylinder 180° opposite to the direction A (Figure 6) to return the lock to the condition shown in Figure 1. Upon withdrawal of the key, the lock is dead locked.

Reference will now be made to Figures 8 to 13 showing a second preferred embodiment of the present invention. In this embodiment there is provided a pear shaped housing 40 of conventional size and configuration to provide for interchangeability with other similarly shaped lock

mechanisms. The lock mechanism includes a lock cylinder 41 having a key access slot 42 extending therethrough to enable a key 13 to be inserted from either end of the cylinder. The housing 40 is split centrally to receive a lock actuating element 43 coaxially surrounding the cylinder 41 with a laterally extending tab 44 adapted to co-operate with locking elements (not shown) associated with the lock mechanism. The lock cylinder 41 includes two sets 45,46 of conventional disc elements 12 such that the disc elements of each set 45,46 are urged into locking engagement with key slots 47,48 in spaced sections of the housing 40. The two sets of disc elements are symmetrically located such that they are operable by insertion of the key 13 from either end to release the disc elements from the key slots 47,48 to enable rotation of the cylinder 41 relative to the housing 40. A retainer disc element 49 is provided to maintain the cylinder 41 in its correct axial location relative to the housing but enabling free rotation of the cylinder subject to the other features of the lock mechanism.

The actuating element 43 is constructed in the form of an annular member having a circumferential groove 50 on one face to accommodate the retainer disc element 49 and a second partially circumferential groove 51 on the opposite end face adapted to co-operate with the blocking member 53 as will be described hereinafter. The blocking member 53 has a generally L shaped configuration. A first portion 54 of the blocking member is adapted to slide within a diametrically extending slot 55 in the lock cylinder. The first portion 54 further includes a key access opening 56 to permit the key 13 to pass therethrough and to effect the sliding movement of the first portion 54 in the slot 55. The free end 51 of the first portion 54 forms the third portion of the blocking member which is movable into and out of the groove 51 in the actuating element 43 upon sliding movement of the portion 54 through the slot 55. The second portion 58 of the blocking member 53 is formed by the other leg 59 of the L shaped member. In the first position the portion

58 is engaged within the key slot 48 of the housing 40 and, after insertion of the key 13, is moved out of the slot 48 and into a slot 60 within the cylinder 41. In this way the blocking member is moved out of interference between the cylinder and the housing and into engagement with the actuating element 43 whereby turning of the key also turns the actuating element. As can be seen in Figures 9, 11 and 13, the blocking member 53 includes a lateral tab 61 which engages a spring 62 acting to urge the blocking member towards the position where the portion 58 engages within the housing key slot 48. A step 63 in one side edge of the portion 54 of the member 53 is adapted to engage with a ledge 64 in the cylinder 41 to limit the possible movement of the blocking member under action of the spring 62.

CLAIMS:

1. A disc tumbler lock mechanism comprising a lock cylinder with a key slot and disc elements adapted for co-operation with a key inserted in said key slot, a housing surrounding said cylinder having recesses co-operable with said disc elements, and an actuating element adapted to be driven in response to movement of said lock cylinder, said lock mechanism being characterized by a blocking member having a first portion restrained for movement with the lock cylinder, a second portion selectively restrained in a first position by said housing but movable out of said first position by insertion of the key into said key slot, and a third portion adapted to drive said actuating element.
2. A lock mechanism according to claim 1 wherein said blocking member is resiliently urged towards said first position.
3. A lock mechanism according to claim 1 or claim 2 wherein said disc elements are symmetrically disposed to accommodate insertion of said key into the lock mechanism from either end of the lock cylinder.
4. A lock mechanism according to any one of claims 1 to 3 wherein the first portion of the blocking member is slidably received within a slot extending at least partially through the lock cylinder.
5. A lock mechanism according to claim 4 wherein the cylinder slot extends diametrically through the lock cylinder.
6. A lock mechanism according to claim 5 wherein one end of said first portion forms the third portion of the blocking member, said one end being adapted to extend beyond the outer surface of the lock cylinder into co-operable engagement with the actuating element surrounding the lock



cylinder, when said key is inserted into the key slot.

7. A lock mechanism according to claim 6 wherein the other end of said first portion forms the second portion of the blocking member, said other end being adapted to extend into and be retained by a recess in the housing when the key is removed from the key slot but said second portion being removable from said recess upon insertion of the key into the key slot.

8. A lock mechanism according to claim 7 wherein said second portion extends substantially at a right angle to said first portion.

9. A lock mechanism according to any one of claims 5 to 8 wherein said first portion includes an opening to permit the key to pass therethrough, at least one edge of said opening in the first portion being engageable with the key upon insertion in the key slot to effect movement of the first portion through the diametral slot.

10. A lock mechanism according to claim 4 wherein the cylinder slot extends axially along at least a portion of the lock cylinder.

11. A lock mechanism according to claim 10 wherein the blocking member is in the form of a U shaped member having a base forming the first portion and free ends forming the second and third portions respectively.

12. A lock mechanism according to claim 11 wherein one of said free ends extends generally axially forming the second portion of the blocking member, said second portion being received in a circumferential groove in said housing permitting free movement of the second portion therealong, and a recess formed in said groove whereby upon removal of the key from the key slot said second portion engages in said



recess to prevent relative movement between the housing and the blocking member. 26

13. A lock mechanism according to claim 12 wherein the other of said free ends extends generally axially forming the third portion of the blocking member, said third portion being received in an arcuate groove in the actuating element whereby upon insertion of the key into the key slot and rotation of the key, the third portion is adapted to engage with an end region of the groove in the actuating element to move said actuating element.

14. A lock mechanism according to any one of claims 10 to 13 wherein the actuating element is disposed at one end of the lock cylinder accessible for manual operation.

15. A lock mechanism according to any one of claims 1 to 14 wherein the blocking member is located between mutually spaced sets of disc elements.

16. A lock mechanism substantially as described herein with reference to the accompanying drawings.

