

SPECIFICATION

Tumbler locks

DESCRIPTION

This invention relates to tumbler locks.

5 In general, a tumbler lock may be taken to be one comprising a housing and a barrel which are relatively rotatable about a longitudinal axis of the lock, the barrel having a key slot extending longitudinally thereof, and a plurality of tumblers
10 movable transversely with respect to said axis and the key slot on insertion of a correct key into the key slot on insertion of a correct key into the key slot between respective positions in a first of which the tumblers prevent said relative rotation of the barrel and housing and in a second of which
15 the tumblers do not prevent such rotation.

Such locks have found great favour in many fields, such as for use with suitcases and trunks and in automobiles, and the cost and size
20 requirements for such articles of common usage is such that the number of tumblers in and the accuracy of manufacture and assembly of the locks may be such that they do not provide a substantial hindrance to a skilled but unauthorised
25 person who wishes to obtain access to the contents of the secured article and who does not have access to the correct key.

In accordance with one aspect of the present invention there is provided a tumbler lock
30 comprising a housing and a barrel which are relatively rotatable about a longitudinal axis of the lock, the barrel having a plurality of tumblers which define a key slot extending longitudinally of the barrel and which are movable transversely
35 with respect to the lock axis between a first, extreme position, wherein the tumblers prevent said relative rotation of the barrel and housing, and a second, intermediate position, wherein the tumblers permit said relative rotation upon
40 insertion of a correct key in the key slot, at least one of the tumblers being movable transversely with respect to the lock axis into a third, extreme position, wherein said at least one tumbler prevents said rotation, and having means for
45 interengaging corresponding means associated with the barrel and for maintaining said at least one tumbler in its third position, when said at least one tumbler is in its third position, such that manipulation of the lock with an implement other
50 than a correct key causes said at least one tumbler to move into its third position to prevent said relative rotation and causes said means to interengage, whereby said at least one tumbler is maintained in its third position such that the
55 attainment of the second intermediate position by all the tumblers is avoided or at least delayed.

In a preferred embodiment of the invention, the tumbler is a plate tumbler and has ends which, in the two extreme positions, cooperate with
60 respective longitudinal slots formed in the housing to prevent said relative rotation, the cooperating means for at least one of these positions comprising cooperating shoulders formed on the tumbler and the wall of the transverse slot in the

65 barrel. Preferably also, there is provided a spring acting between the tumbler and the barrel which forces the shoulders into engagement when the tumbler is in one extreme position. Insertion of a correct key into the key slot can disengage the interengaging shoulders against the action of the
70 spring.

In attempting to release the barrel for rotation relative to the housing in a lock in accordance with the aspect of the invention described above, a person not using a correct key will find that, if he fails to locate the correct intermediate position in passing from one of the extreme positions to the other and overshoots the intermediate position by a sufficient amount, the tumbler is held in the third extreme position and he must then spend a substantial amount of time releasing this tumbler from that extreme position, in order to be able to make a further attempt, assuming that he is able to do so. Thus, it is likely that a lock in accordance with this aspect of the invention will require a substantial amount of time in order to open it and this time period allows it to become more apparent that the person tampering with the lock is such an unauthorised person.

90 According to another embodiment of the present invention, a tumbler lock in accordance therewith has means cooperating with the slot to define a reduced dimension of the slot in the direction of movement of the tumblers.

95 In order to open such a lock without a suitable key, it is necessary for an unauthorised person to have two separate implements for dealing with the tumblers on either side of the reduced dimension and to locate the position of the reduced dimension of the key slot. This requires a substantial time and will serve as a deterrent to an unauthorised person in attempting to open the lock.

100 The groups of tumblers on either side of a reduced, cross-sectional dimension of the key slot may operate in the same or in opposite senses. That is, each group may extend outwardly of the outer surface of the barrel in the opposite sense to the outward extension of the other group of tumblers for locking cooperation with the housing.

110 The invention may be applied to both single and double entry locks. A "double entry" lock is a lock in which the key can be used in both senses, that is the key does not have to be turned a "right way up".

115 The invention will now be explained further, by way of example only and with reference to preferred embodiments thereof which are illustrated in the accompanying drawings, in which:

Figure 1 is a cross-sectional view of a first preferred embodiment of tumbler lock showing a barrel and a housing and a first extreme position, and in dotted outline, an intermediate position of a tumbler in the barrel;

125 Figure 2 is a view of the same embodiment as in Figure 1 showing the tumbler in a third, extreme position thereof with respect to the barrel and the housing;

Figure 3 is a sectional view of a second preferred embodiment of tumbler lock; and

Figure 4 is a view similar to that of Figure 1 of the lock of Figure 1 with a correct key in place in the lock.

Referring now to the first embodiment of tumbler lock shown in Figures 1 and 2, a housing 51 having locating flats 52 and 53 has a longitudinal bore 54 in which is rotatably mounted a generally cylindrical barrel 55. The housing 52 has longitudinal slots 56 and 57 which extend radially outwardly from the bore 54.

The barrel 55 is provided with a series of transverse slots 58, only one of which is shown in the Figures, and in the slot 58 there is a transversely movable plate tumbler 59. The plate tumbler 59 has end portions 60 and 61 dimensioned so as to be able to pass into respective slots 57 and 56 in the housing 51 on corresponding transverse movements of the tumbler with respect to the barrel 55 and the transverse slot 58 therein.

One lateral wall 62 of the transverse slot 58 in the barrel 55 is provided with a shoulder formation 63 and the corresponding lateral wall 64 of the tumbler 59 is provided with two shoulder formations 65 and 66. A further minor shoulder 67 is formed in the lateral wall 64 of the tumbler 59 adjacent the end portion 60 thereof.

The other lateral wall 68 of the transverse slot 58 is also provided with a shoulder formation 69 which faces in the opposite sense to the shoulder formation 63. The other lateral wall 70 of the tumbler 59 is provided with a major shoulder formation 71 and a compression spring (not shown) acts between the shoulder formation 69 of the lateral slot wall 68 and the shoulder formation 71 of the lateral tumbler wall 70. The lateral wall 70 of the tumbler 59 is also provided with a minor shoulder formation 72 adjacent the end portion 61.

A key slot 75 is formed generally centrally of the tumbler 59 and its end faces 76, 77 are located a distance apart so as to correspond with the corresponding portion of a correct key correctly inserted into the key slot to locate the tumbler in the opening position, as will be described below.

In the normal locked position of the tumbler 59, with the key removed from the key slot 75, the spring urges the tumbler into the position shown in Figure 1 in which the shoulder 65 abuts the shoulder 63 on the lateral wall 62 of the barrel 55 and the tumbler end portion 60 is located in its respective barrel slot 57, whereby relative rotation between the barrel 55 and the housing 51 is prevented. On insertion of a correct key into the key slot 75 in the barrel 55 to its fullest extent, so as to locate the correct portion of the key corresponding to the slot 75 in that slot, the lifters on the key locate the end faces 76 and 77 of the slot 75 and cause the tumbler 55 to move into an intermediate position shown in dotted lines in Figure 1. In this position of the tumbler 55, the end portion 60 of the tumbler is removed from the

slot 57 and no longer prevents rotation of the barrel 55 with respect to the housing 51. The key may now be used to rotate the barrel 55 to release whatever locking mechanism is attached to the barrel and housing 51.

If an unauthorised person inserts an incorrect key into the slot or uses another implement other than the correct key to attempt to move the tumbler 59 into its correct intermediate position (that shown in dotted outline in Figure 1), to permit relative rotation between the barrel 55 and housing 51, then, if the tumbler is moved beyond the correct position and into or beyond a position, such as that shown in Figure 2, in which the end portion 62 of the tumbler is located in the slot 56 in the housing, the spring, acting between the shoulder formations 69 and 71, causes the tumbler to pivot into the position shown in Figure 2. In this position, the shoulder formation 66 on the tumbler wall 64 engages with the shoulder formation 63 on the transverse slot wall 62 of the barrel 55, to hold the tumbler in this extreme position. The shoulder formations 67 and 72 on the respective lateral walls 64, 70 of the tumbler are shaped to allow this pivoting movement of the tumbler 59. The tumbler 59 now prevents relative rotation of the barrel 55 and housing 51 by virtue of the location of the end portion 61 of the tumbler in the slot 56 in the housing. If the lock is now to be released, it is necessary for the tumbler to be released from this position, shown in Figure 2, which may well be difficult to somebody who does not have the correct key but which is easily obtained by insertion of a correct key into the key slot 75 and the realignment of the tumbler 59 in the barrel 55 at the intermediate position.

With reference to the embodiment of tumbler lock 1 shown in Figures 3 and 4 of the drawings, a housing 2 which has an internal bore 3 of generally cylindrical cross-section and stepped formation to provide three portions of different diameter. The portion 4 of the bore 3 at the axially outer end thereof (to the left as seen in Figure 3) has the largest diameter. The next portion 5 of the bore 3 has a reduced diameter and the last portion 6 of the bore 3, which is remote from the axially outer end portion 4, has a still further reduced diameter. Diametrically opposed tumbler receiving grooves 7 and 8 are formed in the bore portions 5 and 6 and these extend axially of the bore 3.

A barrel 9 is rotatably mounted in the housing 2 and has a generally circular, outer peripheral surface which is stepped in complementary form to the bore 3 of the housing 2. Thus, the barrel 9 has a portion 10, having an outer diameter corresponding to that of the portion 4 of the housing bore 3, and portions 11 and 12 having outer diameter corresponding to the respective bore portions 5 and 6. Means (not shown) are provided for preventing axial movement of the barrel lying in the housing 2 and, if required, means may also be provided for limiting the degree of relative rotation of the housing and the barrel.

A plurality of slots extend transversely of the

barrel 9 between diametrically opposite points on the peripheral surface thereof. In each slot there is provided a tumbler and the tumblers are divided into two groups. The tumblers 13 of a first group have a length corresponding to the diameter of the barrel portion 11 and are located in slots contained within that barrel portion. Tumblers 14 of a second group of tumblers have a length corresponding to the diameter of the barrel portion 12 and are located in respective slots in that barrel portion. Resilient means (not shown) are provided for urging the tumblers 13 of the first group into the associated portion of the groove 7 on one side of the inner surface of the bore 3 and the tumblers 14 of the other group into an associated portion of the groove 8 on the opposite side of the bore 3.

A key slot 15 extends axially of the barrel 9 and has a generally rectangular cross-sectional shape. The key slot 15 comprises two portions, a portion 16 of a larger transverse dimension than the corresponding dimension of another key slot portion 17. The portion 16 of the key slot is co-terminus, generally speaking, with the bore portions 4 and 5 of the bore 3 in the housing 2.

The key slot portion 17 is generally co-terminus with the portion of the grooves 7 and 8 in the bore portion 6 in the barrel 2. The blind end 18 of the key slot 15 is formed to receive the end of a key and acts as an abutment therefore. Portions 19 and 20 of the wall defining the key slot 15 and lying between the slot portions 16 and 17 are inclined with respect to the axis of the key slot and corresponding to an angle step of the key to allow for operation of the tumblers.

The tumblers 13 have an aperture therein corresponding to the transverse dimension of the key slot portion 16 and the tumblers 14 have an aperture therein of a dimension corresponding to the transverse dimension of the key slot portion 17.

The barrel lock described above is suitable for use with a "double entry" key which is operable in two effective positions at 180° apart in the lock.

In Figure 2, there is shown such a key 21 inserted in the lock and having a configuration such that, when it abuts the blind end 18 in the key slot 15, the tumblers 13 and 14 are all withdrawn into the barrel 9, so that the barrel 9 can rotate relative to the housing 2. The key 21 is formed from a blank which has a stepped formation, a first step 22 serving to locate the key against the end face 22a of the barrel 9. The blank of the key 21 then has a basic transverse dimension corresponding to that of the key slot portion 16 until it reaches a second, angled step 23 at which the blank reduces to a further basic dimension corresponding to the transverse dimension of the key slot portion 17.

The key blank then terminates in a tapered portion 24 complementary to the blind end 18 of the key slot 15. The key is manufactured to provide the lifts corresponding to the required lifts of the tumblers to unlock the barrel with respect to the housing. The key 21 and the key slot 15 may be provided with suitable axial grooving and protrusions in the normal way to extend the

number of combinations available in a key and lock arrangement of a given type.

The invention described in the preferred embodiment of Figures 3 and 4 has reference to a double entry lock in which the key is stepped down from both sides towards the longitudinal axis of the key. The invention is applicable with single entry keys in which the tumbler operating surfaces are provided on one side of the key and it may be used in only one sense in the barrel.

Furthermore the invention has been illustrated with reference to an embodiment in which the two groups of tumblers act in opposite senses in the transverse direction. The invention is also applicable to arrangements in which the two groups of tumblers act in the same sense.

In the manufacture of barrels of the type described, it is often the practice to extend portions of the key slot transversely of the basic dimension required for entry of the key in order to facilitate casting of the barrel. These portions do not normally extend to the full width of the slot. However, if required, it is possible within the ambit of the present invention to make the portions 25, 26 and 27 the full width of the slot 15 or otherwise to arrange such slot portions for facilitating manufacture.

It will be seen that in certain tumbler locks in accordance with the invention there may be provided a stepped formation in the key slot which provides a means defining a reduction in the transverse cross-sectional dimension of the slot in the sense of the movement of the tumblers. In practice, such a slot requires a person seeking to "pick" the lock to use increased expertise in order to release the barrel from the housing. The presence of the stepped formation means that a single implement cannot be used to locate the whole of the two groups of the tumblers in a non-locking position. The stepped formation interferes with the manipulation of the implement. Thus, two implements are required and it is necessary to locate the position of the stepped formation with respect to the end face of the barrel before any attempt at manipulating the two implements is commenced. These procedures represent a considerable increase in the amount of time required to unlock the barrel with respect to the housing and therefore act as a deterrent to an unauthorised person attempting to interfere with the lock.

The present invention has been specifically described with particular reference to two embodiments thereof. It is to be noted that particular details of each of the embodiments can be utilised in the other embodiment as required to meet specific requirements of the embodiment of tumbler lock in question.

Furthermore, it is to be noted that the specific rotation of the shoulder formations, and in particular that of shoulder formations 53 and 66, shown in the illustrated embodiment of Figures 1 to 3 is not the only possible location. The relative or absolute positions can be modified in order to give the desired "overlift" of the

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tumbler with respect to the housing before engagement thereof takes place. They could also be located on the side of the tumbler adjacent the spring.

5 CLAIMS

1. A tumbler lock comprising a housing and a barrel which are relatively rotatable about a longitudinal axis of the lock, the barrel having a plurality of tumblers which define a key slot
- 10 extending longitudinally of the barrel and which are movable transversely with respect to the lock axis between a first, extreme position, wherein the tumblers prevent said relative rotation of the barrel and housing, and a second, intermediate
- 15 position, wherein the tumblers permit said relative rotation upon insertion of a correct key in the key slot, at least one of the tumblers being movable transversely with respect to the lock axis into a third, extreme position, wherein said at least one
- 20 tumbler prevents said rotation, and having means for interengaging corresponding means associated with the barrel and for maintaining said at least one tumbler in its third position, when said at least one tumbler is in its third position, such that
- 25 manipulation of the lock with an implement other than a correct key causes said at least one tumbler to move into its third position to prevent said relative rotation and causes said means to interengage, whereby said at least one tumbler is
- 30 maintained in its third position such that the attainment of the second intermediate position by all the tumblers is avoided or at least delayed.
2. A tumbler lock according to claim 1, wherein said at least one tumbler is movable from both
- 35 extreme positions to the intermediate position by the correct insertion of a correct key into the key slot.
3. A tumbler lock according to claim 1, wherein said at least one tumbler is not movable from one
- 40 of the extreme positions by the correct insertion of a correct key into the key slot.
4. A tumbler lock according to claims 1, 2 or 3, wherein said at least one tumbler is a plate tumbler slidable in a transverse slot of the barrel
- 45 and having ends of which each, in a respective one

of the two extreme positions, cooperates with a respective one of two longitudinal slots formed in the housing to prevent said relative rotation.

- 50 5. A tumbler lock according to claim 4, wherein said interengaging means of said at least one tumbler and said corresponding means associated with the barrel comprise, respectively, cooperable shoulders formed on said at least one tumbler and the wall of the transverse slot of the barrel.

- 55 6. A tumbler lock according to claim 5 comprising a spring acting between said at least one tumbler and the barrel for rotating said at least one tumbler with respect to the lock axis to force the shoulder into engagement when said tumbler is in the third extreme position.

- 60 7. A tumbler lock according to claim 6, wherein, the insertion of a correct key into the key slot disengages the shoulders against the action of the spring.

- 65 8. A tumbler lock according to any preceding claim, wherein all the tumblers are capable of attaining all three positions.

- 70 9. A tumbler lock according to any preceding claim, wherein means are provided for cooperating with the key slot in the barrel to define a reduced dimension of the slot in the transverse direction.

- 75 10. A tumbler lock according to claim 9, wherein groups of the tumblers are located on both sides of the reduced dimension of the slot.

11. A tumbler lock according to claim 10, wherein the groups of tumblers on opposite sides of the reduced dimension of the slot operate in the same sense to prevent said relative rotation.

- 80 12. A tumbler lock according to claim 10, wherein the groups of tumblers on opposite sides of the reduced dimension of the slot operate in opposite senses to prevent said relative rotation.

- 85 13. A tumbler lock according to any preceding claim which is a double entry lock.

14. A tumbler lock according to any of claims 1 to 12 which is a single entry lock.

- 90 15. A tumbler lock substantially as hereinbefore described with reference to Figures 1 and 2, 3 and 4 or Figures 1 to 4 of the accompanying drawings.

tumbler with respect to the housing before engagement thereof takes place. They could also be located on the side of the tumbler adjacent the spring.

5 CLAIMS

1. A tumbler lock comprising a housing and a barrel which are relatively rotatable about a longitudinal axis of the lock, the barrel having a plurality of tumblers which define a key slot
- 10 extending longitudinally of the barrel and which are movable transversely with respect to the lock axis between a first, extreme position, wherein the tumblers prevent said relative rotation of the barrel and housing, and a second, intermediate
- 15 position, wherein the tumblers permit said relative rotation upon insertion of a correct key in the key slot, at least one of the tumblers being movable transversely with respect to the lock axis into a third, extreme position, wherein said at least one
- 20 tumbler prevents said rotation, and having means for interengaging corresponding means associated with the barrel and for maintaining said at least one tumbler in its third position, when said at least one tumbler is in its third position, such that
- 25 manipulation of the lock with an implement other than a correct key causes said at least one tumbler to move into its third position to prevent said relative rotation and causes said means to interengage, whereby said at least one tumbler is
- 30 maintained in its third position such that the attainment of the second intermediate position by all the tumblers is avoided or at least delayed.
2. A tumbler lock according to claim 1, wherein said at least one tumbler is movable from both
- 35 extreme positions to the intermediate position by the correct insertion of a correct key into the key slot.
3. A tumbler lock according to claim 1, wherein said at least one tumbler is not movable from one
- 40 of the extreme positions by the correct insertion of a correct key into the key slot.
4. A tumbler lock according to claims 1, 2 or 3, wherein said at least one tumbler is a plate
- 45 tumbler slidable in a transverse slot of the barrel and having ends of which each, in a respective one

of the two extreme positions, cooperates with a respective one of two longitudinal slots formed in the housing to prevent said relative rotation.

- 50 5. A tumbler lock according to claim 4, wherein said interengaging means of said at least one tumbler and said corresponding means associated with the barrel comprise, respectively, cooperable shoulders formed on said at least one tumbler and the wall of the transverse slot of the barrel.
- 55 6. A tumbler lock according to claim 5 comprising a spring acting between said at least one tumbler and the barrel for rotating said at least one tumbler with respect to the lock axis to force the shoulder into engagement when said
- 60 tumbler is in the third extreme position.
7. A tumbler lock according to claim 6, wherein, the insertion of a correct key into the key slot disengages the shoulders against the action of the spring.
- 65 8. A tumbler lock according to any preceding claim, wherein all the tumblers are capable of attaining all three positions.
9. A tumbler lock according to any preceding claim, wherein means are provided for
- 70 cooperating with the key slot in the barrel to define a reduced dimension of the slot in the transverse direction.
10. A tumbler lock according to claim 9, wherein groups of the tumblers are located on
- 75 both sides of the reduced dimension of the slot.
11. A tumbler lock according to claim 10, wherein the groups of tumblers on opposite sides of the reduced dimension of the slot operate in the same sense to prevent said relative rotation.
- 80 12. A tumbler lock according to claim 10, wherein the groups of tumblers on opposite sides of the reduced dimension of the slot operate in opposite senses to prevent said relative rotation.
13. A tumbler lock according to any preceding claim which is a double entry lock.
- 85 14. A tumbler lock according to any of claims 1 to 12 which is a single entry lock.
15. A tumbler lock substantially as hereinbefore described with reference to Figures 1 and 2, 3 and
- 90 4 or Figures 1 to 4 of the accompanying drawings.