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IMPROVED KEY AND LOCK

This invention relates to a key for a cylinder lock, such as a pin tumbler cylinder lock and also to the combination of the key and its associated lock, the lock per se and a blank for the key.

An object of the invention is to provide a key for use with a cylinder lock incorporating improved security.

According to the present invention there is provided a key for a cylinder lock, the key comprising a shank, a bow at one end of the shank, a tip at the opposite end of the shank, the shank having two spaced longitudinal edge surfaces defining between them the depth of the shank, one of said longitudinal edge surfaces having bitting and terminating at said opposite end in a sloping surface extending to said tip, and the depth of the shank measured from said other longitudinal edge surface being reduced by said other longitudinal edge surface being relieved from said tip in a direction towards said bow, the relief being less at said tip than at a recess disposed inwards of said tip towards the bow for reception, in use, of a blocking element of the cylinder lock, and being no less than at said tip for any other of such relief between the recess and the tip.

According to a further aspect of the invention, there is provided in combination a cylinder lock having a body, a cylinder rotatably mounted in the body, a key slot in the cylinder for receiving a key, a plurality of radially extending pins mounted in radial bores in the cylinder and aligned bores in the body, the pins being biased towards the key slot, each pin being split into

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at least two portions so that the cylinder can be turned only when the interfaces between the pin portions are made by the insertion of an appropriate key to coincide with the surface of the cylinder, and a blocking element projecting from the body into the key slot across said cylinder surface, and a key for the lock, the key comprising a shank, a bow at one end of the shank, a tip at the opposite end of the shank, the shank having two spaced longitudinal edge surfaces defining between them the depth of the shank, one of said longitudinal edge surfaces having biting, for correctly moving said pins so that said interfaces coincide with the surface of said cylinder, and terminating at said opposite end in a sloping surface extending to said tip, and the depth of the shank measured from said other longitudinal edge surface being reduced by said other longitudinal edge surface being relieved from said tip in a direction towards said bow, the relief being less at said tip than at a recess, disposed inwards of said tip towards the bow, into which said blocking element moves, in use, and being no less than at said tip for any other of such relief between the recess and the tip.

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

Figure 1 is a longitudinal side sectional view of a cylinder lock with a key inserted therein, in accordance with the present invention, and

Figure 2 is a sectional view on the line 2-2 of Figure 1.

Figure 1 shows a generally conventional form of pin tumbler cylinder lock comprising a body 10 having a circular section bore 11 therethrough.

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Rotatably fitted in the bore 11 is a plug or cylinder 12 which, at its front end, has an enlarged flange to limit its insertion into the bore 11. At its opposite end, the cylinder is formed with means (not shown) for retaining it in the body, there also being a connecting bar or the like projecting from the end of the cylinder in the normal manner to operate a latch or equivalent.

The cylinder 12 has a key slot 13 formed therethrough, this being in communication, at one side thereof, with a plurality of radial drillings or bores 14 spaced in alignment along the length of the cylinder.

In the 'locked' position of the cylinder, these bores 14 are aligned with corresponding radial bores 15 spaced longitudinally in the body, the bores 15 being in direct communication with the bores 14, as shown in Figure 1. The cylinder is normally secured from rotation in the body by means of a system of pins and springs repeated along the length of the cylinder. Figure 1 shows for each set of aligned bores 14 and 15 a two-part pin in the form of an accommodated pin 16 in the cylinder and an associated driver pin 17, and an associated biasing coiled compression spring 18 in the body. One end of the spring bears against the driver pin, whilst its other end engages a plug which closes the bore 15.

As is well known, the biasing of the springs is such as to force each two-part pin inwards when there is no key in the key slot 13. Normally the accommodated pin is forced to bear against the end of the drilling 14 in the lock cylinder, and in this position its associated driver pin lies across the interface between the outer surface of the cylinder and the inner surface of the bore 11. With all the driver pins lying across the interface in this

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manner, rotation of the cylinder in the body is prevented. When the correct key 21 is however inserted into the key slot 13, the bittings 19 in the (upper) longitudinal edge surface 28 of the shank 20 of the key cause the different length accommodated pins all to move to the position shown in Figure 1 where the interface between these pins and their associated driver pins exactly coincides with the interface between the exterior surface of the cylinder and the inner surface of the bore 11 so that by turning the key the cylinder can be rotated in its lock body. It can be seen that the key has a bow 22 from which the shank 20 extends, the leading free end of the shank having a sloping surface 23 extending forwardly from the final bitting in the upper longitudinal edge surface to a tip 23a, this tip 23a and then the surface 23 engaging the hemispherical lower surface of each accommodated pin 16 as the key is inserted so as to lift these pins and to allow full insertion of the key. As shown in dashed lines in Figure 1, the key can have an ear or stop 24 which engages against a front surface of the cylinder when the key is properly fully inserted. However as will also be mentioned, the key of this arrangement could be formed without such a stop contacting the front surface of the cylinder.

The lock of this invention differs from the conventional pin tumbler lock in having a 'blocking' element 25 which, when no key is inserted in the lock, is positioned across the interface between the outer surface of the cylinder and the inner surface of the bore 11 in the body 10. As will be described, the key for this lock is specially adapted to allow this blocking element to move into the key when the key is inserted into the lock and turned, thus rotating the cylinder 12 in the bore 11 and thus operating the lock.

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As can be seen from Figures 1 and 2, the element 25 is, in this example, in the form of a spherical element, such as a ball-bearing. With the lock in the orientation shown in the Figures, part of the inner surface of the bore 11 in the body 10 is formed with a part-spherical recess 26, at a position diametrically opposed to, and axially aligned with, the innermost pin of the pin tumbler lock, i.e. the pin furthest from the front of the lock where the key is inserted as shown in Figure 1. However it is not essential that this recess 26 is aligned axially with the position of this innermost pin and, as will be described, the position of the recess, with a suitably adapted key, could be beyond said innermost pin in a direction away from the front of the lock, or alternatively it could be at any position between the front of the lock and said innermost pin. As shown in the Figures, the radial position of the recess is such that it is in the same plane as the bores 14, so that with the lower part of the ball-bearing received in the recess 26, the remainder of the ball-bearing projects into the key slot 13 which is also in the same plane as said bores 14, this arrangement being best shown in Figure 2. However if required, for example if a larger ball-bearing were used, respective lower parts of the cylinder at opposite sides of the key slot 13 could be cut away to accommodate the ball-bearing in its position when it moves out of the body, as will be described, and also, if necessary, in its 'rest' position where it is across the interface between the cylinder and the body.

In the embodiment illustrated the bore 14 receiving the accommodated pin in the cylinder is extended compared to the other bores 14 so that with no key inserted in the cylinder the hemispherical end of the accommodated pin 16 is spring loaded via its associated driver pin 27 to engage the ball-bearing and hold it as shown in Figures 1 and 2 across the interface between the cylinder

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and the body. With this arrangement the driver pin 27 would be extended as shown to ensure that with the pin 16 engaging the ball-bearing, the extended length driver pin is across the (upper) interface between the cylinder and the body. With this arrangement the ball-bearing would initially be inserted, on assembly, down from the top of the body through the bore 14 so that it is received into the recess 26 as shown in Figures 1 and 2, with the accommodated pin 16, extended driver pin 27 and spring 18 being thereafter inserted through the bores 14 and 15 in the normal manner for a conventional pin tumbler lock.

A key of this invention differs from a conventional flat key for operating a pin tumbler lock in that at its free end, i.e. its end remote from the bow, the opposite longitudinal edge surface 29 of the shank, i.e. the lower surface of the shank as viewed in Figures 1 and 2, is relieved or cut away rearwardly from the tip 23a to define a recess 30 to allow for reception of the whole of the interface element 25 when the key is inserted and turned, as will be described. Since the depth of the key is defined between surfaces 28 and 29, this relieving of the shank reduces its depth. As shown in the drawings, the cutting away in this embodiment is such as to form a straight longitudinal edge surface 31 which extends from said tip 23a to the recess 30, this surface 31 being parallel to said edge surface 29. The recess 30 itself has a part-arcuate surface portion 32 to which the surface 31 extends, and a further, straight surface portion 33 extending from the portion 32 to the edge surface 29 with the surface 33 being at 90° to said surface 29. For a reason to be explained, the recess 30 extends inwards of the depth of the shank to a greater extent than the remainder of the relief, i.e. the portion relieved from the recess to the tip 23a.

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As can be seen from the drawings, the relief at the end of the key which defines the recess extends, in this embodiment, across the whole of the width of the flat key. It can thus be seen that the recess provides space within the key, and thus within the key slot of the cylinder for reception of the whole of the ball-bearing so that, as will be described, it can move out of its recess 26, i.e. out of any part of the body, and clear of the interface at the recess 26 when the correct key is inserted into the lock and turned. As will be appreciated, and as previously mentioned, the blocking element could be provided anywhere along the lower inner surface of the bore 11 for use with an associated adapted key where the relief or cut away extends sufficiently from the free end of the key so that the recess 30 is positioned axially in line with the recess 26 when the key is fully inserted in the lock. Thus if the ball-bearing were positioned further from the front of the lock, the recess 30 would need to be positioned nearer the end of the key shown in Figure 1, or alternatively the shank of the key would need to be of longer length. Alternatively if the ball-bearing were positioned nearer the front of the lock, for example in line with the middle two-part pin, then the relief from the end of the key would need to extend further towards the bow than that shown so as to position the recess 30 in line with the ball-bearing at said middle two-part pin.

As the innermost spring loaded pin is arranged to engage the ball 25, the tip of the key has to be arranged to meet the joint between this pin and the ball, so that it causes them to separate and lift the pin along surface 23 as the key is fully inserted. The cavity formed by the relief can be of any shape, but

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has to have a recess which is 'deeper' than the relief at the tip in order to allow the ball to move wholly out of the lock body.

Accordingly, with the embodiment illustrated, the arrangement is that when no key is received in the lock all the driver pins are across the (upper) interface between the cylinder and the body whilst the ball-bearing is across the (lower) interface between the cylinder and the body as shown in the Figures. Clearly the ball-bearing will prevent full insertion of a standard key, i.e. one with no relief at its end, and also a key having a relieved end, but where the relief is insufficient to allow passage of the relieved end over the ball-bearing, or where the key tip is not positioned to lift the pin from the ball-bearing. If the relief is sufficient to allow passage of the relieved end over the ball-bearing and the key pin is correctly positioned, then full insertion is possible. However unless the relief includes a 'deeper' part, rotation by the key of the cylinder is prevented by the ball-bearing as there is then no space in the key for it to be wholly received into it so that it is out of the body.

When the correct key 21 is inserted, the correct bittings raise the first four two-part pins to the correct position as shown in Figure 1 to allow turning of the cylinder. Moreover the correct tip 'height' lifts the pin from the ball and additionally insertion of the correct key brings the deeper recess 30 in alignment with the ball-bearing as shown in Figure 1 after the relieved end of the key has passed over it. The correct insertion position can be determined by the ear 24 engaging the front of the cylinder if said ear is provided. In this position the surface portion 33 of the recess can be in engagement with the ball-bearing or can be just clear thereof. Alternatively if no ear or

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equivalent stop is provided adjacent the bow, it can be arranged that the surface portion 33 acts as a stop by engaging directly against the ball-bearing in its blocking position shown in Figure 1.

In either event, when the key has been correctly inserted and turned, the angular movement of the cylinder together with the shape of the ball-bearing will be such as to produce side pressure to drive the ball-bearing to move upwardly, as viewed in Figures 1 and 2, out of its recess 26 so as to be fully received in the recess 30 formed by the surfaces 32 and 33. Once the ball-bearing is fully received in the recess 30, continued rotation of the key causes angular movement of the cylinder in its bore 11 relative to the body 10 so as to allow normal operation of the lock. Clearly after the lock has been operated, turning of the key, and thus the cylinder in the opposite direction will return the ball-bearing to a position where it again drops partly to be received in the recess 26 and thus again to block insertion of an incorrectly relieved and tipped key. As described, once the key is removed the innermost accommodated pin 16 is biased down onto the ball-bearing.

As stated, the blocking element can be of any alternative suitable form and could be spring biased in a direction towards the key slot. Thus for example with the arrangement shown in Figure 1, the spring 18 could be arranged to be stronger than the biasing spring on the blocking element 25 so that this element 25 is retained in place when no key is inserted in the lock. When the key is then inserted and this end pin lifted, the biasing spring will force the interface element into the relieved portion at the end of the key as the key is inserted until, upon full insertion of the key the element 25 will be received in the recess 30 intended therefor. Accordingly with this arrangement the

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blocking element would be wholly received in the key prior to commencement of the rotation thereof.

In an alternative arrangement the blocking element could be of reduced width so that accordingly the end of the key need not be relieved across its whole width. In other words it will be relieved only at one side or the other or it could be relieved centrally to provide a passage which is closed at its respective opposite sides.

As explained hereinbefore, the blocking element does not prevent cylinder rotation but does prevent insertion of an incorrect 'shape' of key. Cylinders are commonly machined to fit a particular key profile to add to their security. The present invention introduces a shape to the outline profile of the key, but instead of meeting a fixed ward, the action is dynamic in that the member moves and requires a cavity of a particular depth in the key.

CLAIMS

1. A key for a cylinder lock, the key comprising a shank, a bow at one end of the shank, a tip at the opposite end of the shank, the shank having two spaced longitudinal edge surfaces defining between them the depth of the shank, one of said longitudinal edge surfaces having bitting and terminating at said opposite end in a sloping surface extending to said tip, and the depth of the shank measured from said other longitudinal edge surface being reduced by said other longitudinal edge surface being relieved from said tip in a direction towards said bow, the relief being less at said tip than at a recess disposed inwards of said tip towards the bow for reception, in use, of a blocking element of the cylinder lock, and being no less than at said tip for any other of such relief between the recess and the tip.
2. A key as claimed in Claim 1, wherein the recess is part-arcuate to receive said blocking element in the form of a ball-bearing, in use.
3. A key as claimed in Claim 1 or Claim 2, wherein the relieved end of the key is formed with a straight longitudinal edge surface which is parallel to said other longitudinal edge surface of the shank and which leads to said recess.
4. A key as claimed in Claim 3, wherein said straight longitudinal edge surface extends from said recess to said tip where it joins said sloping surface.

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5. A key as claimed in any one of Claims 1 to 4, wherein the recess is formed with a surface extending to said other longitudinal edge surface and at 90° or substantially 90° thereto to define a stop surface to engage against said blocking element, in use, upon key insertion into said cylinder lock.

6. A key as claimed in any one of Claims 1 to 4, wherein there is a stop on at least one of the longitudinal edge surfaces at a position adjacent the bow to limit key insertion into said lock, in use.

7. In combination, a cylinder lock having a body, a cylinder rotatably mounted in the body, a key slot in the cylinder for receiving a key, a plurality of radially extending pins mounted in radial bores in the cylinder and aligned bores in the body, the pins being biased towards the key slot, each pin being split into at least two portions so that the cylinder can be turned only when the interfaces between the pin portions are made by the insertion of an appropriate key to coincide with the surface of the cylinder, and a blocking element projecting from the body into the key slot across said cylinder surface, and a key for the lock, the key comprising a shank, a bow at one end of the shank, a tip at the opposite end of the shank, the shank having two spaced longitudinal edge surfaces defining between them the depth of the shank, one of said longitudinal edge surfaces having bitting, for correctly moving said pins so that said interfaces coincide with the surface of said cylinder, and terminating at said opposite end in a sloping surface extending to said tip, and the depth of the shank measured from said other longitudinal edge surface being reduced by said other longitudinal edge surface being relieved from said tip in a direction towards said bow, the relief being less at said tip than at a recess, disposed inwards of said tip

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towards the bow, into which said blocking element moves, in use, and being no less than at said tip for any other of such relief between the recess and the tip.

8. A combination as claimed in Claim 7, wherein prior to insertion of the key one of said biased pins engages said blocking element to hold it in position across the cylinder surface.

9. A combination as claimed in Claim 8, wherein the pin engaging the blocking element and at least part of said blocking element are in a bore extending through the cylinder.

10. A combination as claimed in any one of Claims 7 to 9, wherein the blocking element is shaped such that when the key is inserted into the lock and the lock cylinder turned thereby, in use, the engagement between the body and the blocking element forces the blocking element to be received fully into said recess in the key.

11. A combination as claimed in Claim 10, wherein the blocking element is spherical.

12. A combination as claimed in Claim 11, wherein the blocking element is a ball-bearing.

13. A combination as claimed in any one of Claims 7 to 12, wherein at least part of the recess is shaped to match the shape of at least part of the blocking element received therein, in use.

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14. A combination as claimed in Claim 13, wherein the recess is part-arcuate to receive said blocking element in the form of a ball-bearing, in use.

15. A combination as claimed in any one of Claims 7 to 14, wherein the relieved end of the key is formed with a straight longitudinal edge surface which is parallel to said other longitudinal edge surface of the shank and which leads to said recess.

16. A combination as claimed in Claim 15, wherein said straight longitudinal edge surface extends from said recess to said tip where it joins a sloping end surface of the shank which extends from said one longitudinal edge surface having said biting.

17. A combination as claimed in any one of Claims 7 to 16, wherein the recess is formed with a surface extending to said other longitudinal edge surface and at 90° or substantially 90° thereto to define a stop surface to engage against said blocking element, in use, upon key insertion into said cylinder lock.

18. A combination as claimed in any one of Claims 7 to 16, wherein there is a stop on at least one of the longitudinal edge surfaces at a position adjacent the bow to limit key insertion into said lock, in use.

19. A key for use in a combination as claimed in any one of Claims 7 to 18.

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20. A lock for use in a combination as claimed in any one of Claims 7 to 18.

21. A key blank comprising a shank, a bow at one end of the shank, a tip at the opposite end of the shank, the shank having two spaced longitudinal edge surfaces defining between them the depth of the shank, one of said longitudinal edge surfaces being intended to be provided with bitting and terminating at said opposite end in a sloping surface extending to said tip, and the depth of the shank measured from said other longitudinal edge surface being reduced by said other longitudinal edge surface being relieved from said tip in a direction towards said bow, the relief being less at said tip than at a recess disposed inwards of said tip towards the bow for reception, in use, of a blocking element of the cylinder lock, and being no less than at said tip for any other of such relief between the recess and the tip.

22. A key substantially as hereinbefore described, with reference to, and as shown in Figure 1 of the accompanying drawings.