Sept. 6, 1966 W. J. KERR 3,270,538

TAMPER-PROOF AXIAL TUMBLER LOCK

Filed June 11, 1965

FIG 1

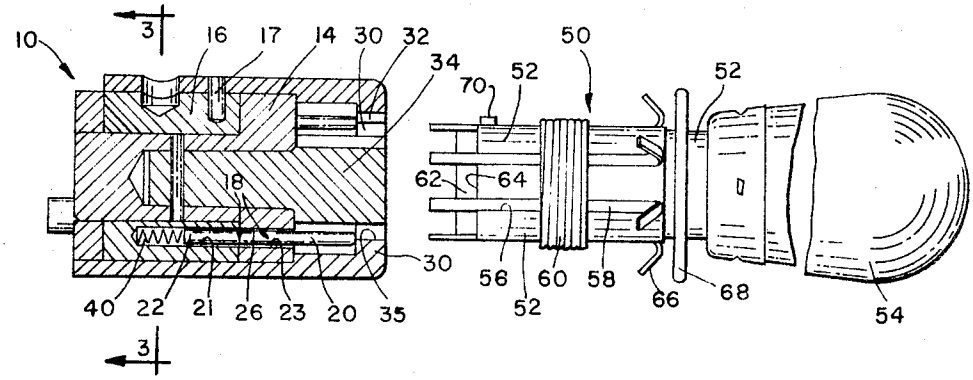


FIG 2

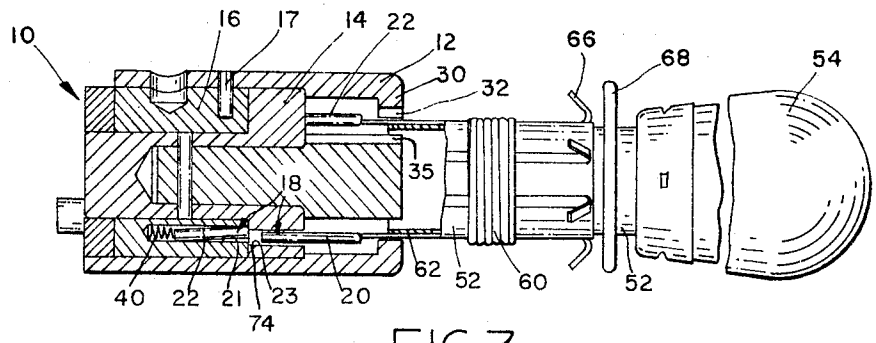


FIG 6

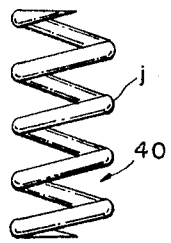


FIG 4

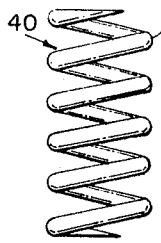


FIG 3

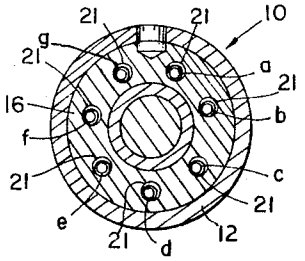


FIG 7

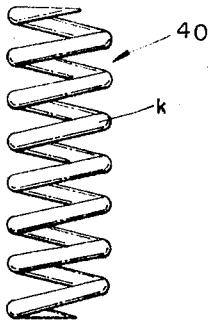


FIG 5

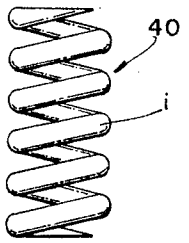
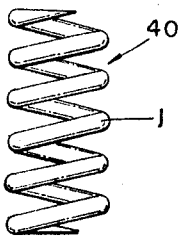


FIG 8



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TAMPER-PROOF AXIAL TUMBLER LOCK

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Filed June 11, 1965, Ser. No. 463,102
4 Claims. (Cl. 70—363)

The present invention relates generally to tumbler locks and has particular reference to that type of tumbler lock wherein the various tumblers thereof are axially shiftable with respect to the lock cylinder. In a lock of this general type, the tumblers slide in bores and pass from the stationary part (cylinder) of the lock into the rotatable part. Furthermore, the tumblers are transversely divided or split and are adapted to be longitudinally or axially displaced by the proper key for the lock against the resistance of helical springs and in such a manner that their splits or joints coincide with the abutting surfaces of the stationary and rotatable parts of the lock. For that purpose, the key which controls the lock is provided with an annular series of push pins or other shoulder-forming members of unequal but definite or predetermined length, the various lengths being commensurate with the extent to which their respective or associated tumblers must be forced back into the pin-receiving bores of the lock so that all of the splits or joints of the tumblers will coincide with said abutting end surfaces of the stationary and rotatable parts of the lock and thus permit the rotatable part to be turned by the key. Locks of the character briefly outlined above have for many years been marketed by Chicago Lock Co., Chicago, Illinois, under the trade name "Ace." They are frequently referred to as barrel-type locks.

There are at the present time a number of picking tools which are ostensibly for use by locksmiths, are capable for use in connection with barrel-type or "Ace" locks, and can be manipulated with varying degrees of skill to open such locks when the keys therefor are lost or are otherwise unavailable. One such picking tool is shown and described in United States Patent No. 3,149,487, granted on September 22, 1964, and entitled, "Servicing Tool for Barrel-Type Locks." Another picking tool for the same purpose forms the subject matter of United States Patent No. 2,655,808, granted on October 20, 1953, and entitled, "Pick for Tubular Locks." Other picking tools which are capable of opening "Ace" locks have been uncovered from time to time both from authorized and unauthorized sources.

Picking tools which are capable of opening "Ace" locks are structurally similar in that each of them is in the form of a tool which, by means of a handle, may be manipulated so that tumbler-engaging fingers which are arranged in an annular series, conform to the arrangement of the tumblers of the lock to be opened and are under light frictional drag, are initially entered into the front end of the lock in order to engage and rearwardly depress the tumblers against the bias of their respective helical springs. The handle may then be placed under a manual rotational bias or torque in the direction of lock opening and reciprocated in and out, that is, longitudinally, while at the same time the operator of the tool gradually withdraws the tool from the lock. During such jiggling of the tool, the split tumblers gradually slide forwardly. Because of wide tolerances which are ordinarily maintained in the manufacture of the lock parts, the rotational bias which is applied to the tool causes a slight misalignment of the bores in the stationary and rotatable parts of the lock, thus presenting at the inner ends of the bores in the rotatable part shoulders upon which the front ends of the tumbler sections (follower pins) in the stationary lock part may come to rest when the splits of the tumblers coincide with the abutting end surfaces of the stationary and rotatable lock parts, that is, the interfacial plane between the stationary and rotatable parts of the lock. As a result, the dividing lines or splits of the tumblers gradually become aligned with said interfacial plane between the rotatable and stationary lock parts. When all of the dividing lines or splits of the tumblers become aligned with the interfacial plane, the rotatable part is released for rotation and the lock may then be opened, the opening thereof being an automatic one by reason of the constant rotational bias or torque which is maintained by the tool operator upon the handle of the picking tool.

During such a lock picking operation, the aforementioned tumbler-engaging fingers of the picking tool retract to different endwise positions according to the lengths of the tumblers and they may be locked or otherwise held in such positions to provide a coded pattern for production of one or more duplicate keys for the picked lock.

While the manufacturer of "Ace" locks has no objection to possession of such lock picking tools by locksmiths and other authorized personnel, it occasionally happens that such tools fall into the hands of unauthorized persons who use the same in an illicit manner to pilfer vending and other machines which are equipped with "Ace" locks. At the risk of depriving authorized personnel from enjoying the benefits of possession of such lock-picking tools, it is the principal object of the present invention to provide a barrel-type or axial tumbler lock which may not be opened by means of lock-picking tools which operate upon the principles heretofore set forth and are like those of the two aforementioned United States patents.

In carrying out this object, the invention contemplates the provision of a barrel type or "Ace" lock which deviates from a conventional barrel-type lock solely by the use of tumbler-biasing springs which, among themselves, vary in their respective spring rates, i.e., their tumbler-biasing strength. By such an arrangement, the sensitivity of a lock-picking tool such as has been briefly outlined above, is completely destroyed and an operator is unable properly to manipulate such a tool to advantage. Not only is the sensitivity of the picking tool destroyed, but also the operator's skill, however great, is defeated in that the accustomed response to his various manipulations are lacking and there is, therefore, no intelligent basis on which he may conduct his sequential tumbler split aligning operations. The manner in which the use of springs having different relative strength values or rates serves to render conventional lock-picking tools ineffective for lock opening purposes will become readily apparent as the following description ensues.

In the accompanying single sheet of drawings forming a part of this specification, several embodiments of the present invention are illustrated.

In these drawings:

FIG. 1 is a sectional view taken substantially centrally and longitudinally through a barrel-type or axial tumbler lock employing helical tumbler-biasing springs having different spring rates in accordance with the present invention, a picking tool being shown in side elevation and juxtapositioned for entry into the lock;

FIG. 2 is a sectional view similar to FIG. 1 but showing the picking tool inserted into the lock;

FIG. 3 is a transverse sectional view taken substantially on the line 3—3 of FIG. 1; and

FIGS. 4 to 8, inclusive, are side elevational views of different tumbler-biasing springs capable of being employed in connection with the present invention.

Referring now to the drawings in detail, and in particular to FIGS. 1 and 3, a barrel-type or axial tumbler lock embodying the principles of the present invention is identified in its entirety by the reference numeral **10**, and insofar as its outward appearance and internal structure are concerned, it is with one exception of conventional

construction or design, the exception residing in the use of tumbler-biasing springs having different spring rates, i.e., tumbler-biasing strengths as will be described in detail presently.

The lock **10** is substantially identical with the lock which is shown and described in United States Patent No. 1,984,202, granted on December 11, 1934 and entitled "Key for Locks." Briefly, the lock **10** involves in its general organization a lock cylinder **12** within which there is disposed a rotatable sleeve-like part **14** and a stationary sleeve-like part **16**. The stationary part **16** is maintained within the cylinder **12** against relative rotation by means of a radial pin **17**. Split tumblers **18** which are arranged in an annular series and consist of outer driver pins **20** and inner spring-pressed follower pins **22** are slidable longitudinally in respective bores **23** and **21** in the rotatable and stationary parts of the lock **10**. The tumblers are adapted to be rearwardly displaced by a key (not shown) and when they are so displaced that all of the joints or splits **26** are in transverse register with the abutting end surfaces of the rotatable and stationary parts of the lock, that is, the interfacial plane between such parts, the rotatable part **14** may be turned within the lock cylinder in the usual manner of key operation. The splits **26** are at different longitudinal locations when the tumblers are in their normal positions within the lock cylinder.

The lock cylinder **12** has an inwardly extending front flange **30** which is provided with a radial notch **32** for entrance of a guide lug on the key. A pilot post **34** is movable with the rotatable lock part **14** and cooperates with a socket in the front end of the key in order to facilitate proper entry of the key into the lock cylinder **12** through the annular lock opening **35** which is defined by the flange **30** and the post **34**. For a full disclosure of a key that is suitable for cooperation with the lock **10**, reference may be had to aforementioned Patent No. 1,984,202.

The various split tumblers **18** are yieldingly biased or urged forwardly by means of respective helical springs which are collectively identified by the reference numeral **40** and are disposed in the rear ends of the bores **21**. The reaction force of the springs **40** are assimilated by the inwardly extending front flange **30** in the normal locked condition of the lock. In the locked condition of the lock **10**, the various bores **21** and **23** remain in axial alignment or register and with the various splits **26**, or at least one of them, out of register with the interfacial plane between the rotatable and stationary lock parts **14** and **16**. In the unlocked condition of the lock **10**, all of the splits **26** are in circumferential alignment with one another, as well as with such interfacial plane, as is customary in connection with locks of the axial tumbler type.

Heretofore, with conventional barrel-type or axial tumbler locks, all of the springs **40** which are associated with a given lock are of equal spring rate, that is, they have for all intents and purposes the same compressional characteristics and exert the same tumbler-biasing characteristics. It has, therefore, been possible to open such a conventional lock by means of a picking tool such as that which is illustrated in FIGS. 1 and 2 and is identified in its entirety by the reference numeral **50**. This tool **50** is in the form of a tubular shank **52** which carries a handle **54** at its front end and has an annular series of longitudinally extending grooves **56** in its outer cylindrical surface. Each of the grooves **56** has longitudinally slidable therein a tumbler-engaging finger **58** and all of the fingers are held in position within their respective grooves by means of one or more bands **60** of rubber or other elastomeric material. The rear or left-hand end region of the shank **52**, as viewed in FIGS. 1 and 2, is formed with a reduced diameter section **62**, which defines a rearwardly facing annular shoulder **64**, the reduced section being of such limited diameter that it may enter the annular lock opening **35** to the extent permitted by the shoulder **64**. The front or right-hand ends of the fingers **58** are turned outwardly as shown at **66** for individual manipulation of the fingers, and a flat washer-like ring **68** loosely surrounds the shank **52** near the handle **54** and forwardly of the fingers **58** for collective manipulation of the fingers in a manner that will be made clear presently.

The number and disposition of the slidable tumbler-engaging fingers **58** correspond to the number and disposition of the split tumblers **18** so that when the reduced section **62** of the shank **52** of the tool **50** is inserted in the lock opening **35**, the rear or left-hand ends of the fingers **58** will engage the front ends of the driver pins **20**, thus shifting the various split tumblers **18** rearwardly within the lock cylinder.

It is to be noted at this point that the terms "front" and "forwardly" and the terms "rear" and "rearwardly" as employed herein are with reference to the lock **10**, the front end of the lock cylinder **12**, for example, being regarded as the right-hand end thereof as viewed in FIGS. 1 and 2. This directional reference has been retained in connection with the picking tool **50**, the handle **54**, for example, being considered to be at the front end of the tool.

The reduced section **62** of the shank **52** is formed with an outwardly extending radial lug **70** which enters the radial notch **32** when the tool **50** is inserted into the lock and by means of which the various fingers **58** are constrained to become aligned with their respective or associated tumblers **18** during operation of the picking tool **50**.

In the operation of the tool **50**, the various fingers **58** are caused to project rearwardly beyond the rear end of the tubular shank **52** so that they overhang the shoulder **64**. The fingers may be collectively moved to such a projecting position by manually sliding the washer **68** rearwardly on the shank so that it engages all of the outturned portions **66** of the fingers **58** and forces the fingers rearwardly. Thereafter, the rear ends of the fingers may be caused to lie in the transverse plane of the rear end of the shank by pushing the tool bodily and endwise against a flat surface until the adjacent ends of the fingers and the shank become coplanar. The tool may then be inserted into the lock **10** as previously described so that the shank **52** is telescopically received over the pilot post **34** and the read ends of the fingers **58** engage the front ends of the driver pins **20** and shift all of the split tumblers **18** rearwardly in the bores **23** and **21** until such time as the shoulder **64** engages the front face of the inwardly extending front flange **30** on the lock cylinder **12**. At this time, all of the joints or splits **26** of the tumblers **18** will lie rearwardly of the interfacial plane between the rotatable and stationary lock parts **14** and **16**.

The adjustment of the frictional resistance to longitudinal sliding movement of the fingers **58** within their respective grooves **56** is fairly critical and it cannot always be predetermined for any given lock. In any event, it is essential that the fingers **58** will yield to sliding movement under the influence of the springs **40** operating through the tumblers **18** after these springs have been compressed an appreciable degree. The extent of such yielding movement must, however, not be complete and upon initial insertion of the tool **50** into the lock **10** as limited by the shoulder **64**, no individual tumbler **18** must yield to the pushing action of the associated finger **58** to such an extent that the split **26** thereof will cross forwards of the interfacial plane between the rotatable and stationary parts of the lock and enter the associated bore **23**. If, by withdrawing the tool from the lock and inspecting the ends of the fingers, it is seen that any one of the same are materially retracted, an additional rubber band **60** will be added to the aforementioned band to increase the frictional resistance of the fingers to sliding movement within the grooves **56**. On the other hand, if such inspection reveals that none of the fingers has shifted its position, then one or more bands **60** will be removed from the band group.

While it would be possible to explain the specific action of the various tumbler-engaging fingers **58** on the basis of a discussion of the initial overcoming of the coefficient of running friction into the group of rubber bands **60**, such a discussion is unnecessary herein since no claim is made to any novelty associated with the tool **50**. It is deemed sufficient to state that after the tool has been fully introduced into the lock as described above, a rotational bias is applied to the handle **54** in a lock opening direction, while at the same time a fore-and-aft jiggling action is applied to the tool bodily as a unit tending to reciprocate the tool axially with a series of short strokes. This motion of the tool sets up an intermittent and gradual releasing movement on the front ends of the tumblers **18**, and as a result thereof, bias of the various springs **40** becomes effective to project the tumblers **18** forwardly. As the tumblers thus are intermittently and in small increments of motion projected forwardly, the various tumbler-engaging fingers **58** are similarly intermittently shifted rearwardly in the grooves **56**, it being understood that during such shifting movement of the tumblers and the fingers, the rotational bias of the tool **50** as a whole in a lock-opening direction is manually maintained and transmitted to the rotatable part **14** of the lock.

Referring now specifically to FIG. 2, it will be observed that the rotational bias just referred to serves to effect a slight axial misalignment between the bores **23** in the rotatable part **14** and the bores **21** in the stationary part **16** of the lock. Such misalignment establishes a small crescent-shaped shoulder **74** at the juncture between each coacting pair of bores **21** and **23** and against which the forward end of the associated follower pin **22** may come to rest.

The projective movement of the tumblers is relatively slow, but gradually first one and then another and finally all of the tumblers will become projected until the front ends of the follower pins **22** all seat on respective crescent-shaped shoulders **74**. At this time, all of the splits, other than the final one, may have become widened by movement of the driver pins **20** away from the seated follower pins **22**. The final split **26** will remain at the interfacial plane between the rotatable and stationary parts of the lock, and since a rotational bias in a lock opening direction is constantly maintained on the rotatable part **14**, the rotatable lock part **14** will immediately move to its unlocked position as soon as the final split arrives at the interfacial plane of the two relatively rotatable lock parts.

Started otherwise and in short, the jiggling action of the tool **50** coupled with its rotational bias, causes the various tumblers successively to arrive and wait in a lock-releasing position. As soon as all of the tumblers have arrived at their lock-releasing position, the lock is automatically released.

Stated otherwise and in short, the jiggling action of the retracted fingers have positions that bear the same relationship to the tool shank **52** that the splits **26** normally bear to the bores **23**, the tool may now serve as a pattern for the cutting of a new key which will open the lock **10**.

It should be remembered that the above discussion of the operation of the picking tool **50** is predicated upon the opening of a conventional barrel-type or "Ace" lock in which all of the springs **40** have the same spring rate, i.e., compressional characteristics. The lock of the present invention will effectively defeat the purpose of the tool **50** or of any other similar tool which operates upon the same principle of gradual projection of tumbler-engaging fingers.

The present invention is predicated upon the fact that the use of springs such as the springs **40** which have different spring rates will prevent effective operation of the tool **50** or of other tools which operate upon the same basic principle. It is not necessary that the spring rate of each spring **40** differ from the spring rate of each other spring, the use of a single spring having a spring rate appreciably greater than the common spring rate of all the other springs being sufficient under certain circumstances to defeat the purpose of the tool **50**. An effective tamper-proof combination of spring rates may be attained when three of the springs **40** have a rate which is different from the rate of the other four springs in the annular series of springs. Irrespective, however, of the particular spring rate differential which is maintained, the essential features of the present invention are at all times preserved.

In FIG. 3, the seven springs **40** have been individually and additionally designated at *a, b, c, d, e, f* and *g*. For purposes of discussion herein, let it be assumed that the spring **40***e* exerts an appreciably greater force on its associated split tumbler **18** than do the remaining springs **40***a*, **40***b*, **40***c*, **40***d*, **40***f* and **40***g*. If it is further assumed that the picking tool **50** is preconditioned as previously set forth, inserted into the lock **10**, and manipulated to impart to it the desired jiggling or reciprocating motion, it will be found that the intial insertion of the tool into the lock will serve to depress the six tumblers that are associated with the springs **40***a*, **40***b*, **40***c*, **40***d*, **40***f* and **40***g* to such an extent that the splits **26** thereof will move rearwardly past the interfacial plane between the rotatable and stationary parts of the lock, but the tumbler that is associated with the spring **40***e* will not thus be depressed because of the greater resistance of the spring. The operator may not discover this fact until he has repeatedly tried to open the lock. However, withdrawal of the tool **50** from the lock and an inspection thereof will reveal the fact that the nger **58** corresponding to the particular tumbler under consideration will have been inordinately retracted along the shank **52** of the picking tool. In an effort to remedy this situation, the operator will then estimate the retarding strength of the rubber band group **60** necessary to hold the particular finger **58** against such retraction and he will add one or more rubber bands to the group **60**. Upon again attempting to use the tool **50**, the operator will find that although the particular finger under consideration is now properly held against undue retardation and the associated follower pin **22** will now find a seat against one of the crescent-shaped shoulders **74**, the added over-all strength of the rubber band group is such as to prevent incremental shifting of any of the other tumbler-engaging fingers **58** or consequent gradual drifting of the associated tumblers **18** toward their positions of release.

The use of a single spring which has a spring rate that is different from the spring rate of any one other spring in the series will, therefore, defeat the operation of the tool **50** or of any similar tool which operates upon the same principle of incremental advance of the tumblers toward their position of release. Where, in the interests of economy of manufacture, the seven springs **40** are constructed so as to provide two groups of springs, one group having identical spring rates and the other group also having identical spring rates which differ from the spring rates of the first group, defeat of the picking tool **50** is doubly assured for obvious reasons.

The manner in which different spring rates may be attained can be accomplished in various ways. For example, in FIG. 4, the spring **40***h* represents a stainless steel spring having a predetermined wire gauge, pitch, length and over-all diameter and these are calculated according to engineering expediences to give a desired spring rate. Varying the wire gauge of the spring **40***h*, other things being equal, will vary the rate of the spring. Thus, in FIG. 5, the spring **40***i* which is formed of heavier gauge material will have a greater spring rate than spring **40***h*. Conversely, a spring that is formed of a lighter gauge material will have a lesser spring rate.

The pitch of a spring may be varied to alter its spring rate. In FIG. 6, the spring **40***j* is shown as having fewer convolutions than the spring **40***h* and, therefore, its spring rate is greater. Conversely, a spring having a greater number of convolutions will have a lesser spring rate.

The length of a spring may be varied to alter the spring's

spring rate. In FIG. 7, the spring 40*k* is shown as being appreciably longer than the spring 40*h* and, therefore, its spring rate will be appreciably less than the spring rate of the spring 40*h*. Conversely, a spring which is of shorter length will have a greater spring rate.

The spring rate of a spring may also be varied by employing different spring materials for its construction. Other things being equal, the Phosphor bronze spring 40*l* of FIG. 8 will have a lesser spring rate than that of steel spring 40*h*.

Other ways of varying the spring rate of a spring are contemplated but have not been illustrated herein. One such way is to vary the temper of the material of the spring, as, for example, by subjecting it to different heating and quenching operations. Varying the overall diameter of a spring will also vary its spring rate, but since the diameter of a tumbler-biasing spring is limited by the diameter of the bore in which it is housed, it is not desirable that such an expedient be resorted to although it is within the purview of the present invention so to vary the spring diameter.

From the above description, it will be appreciated that the present invention consists, in the main, in the use of springs having different spring rates in the tumbler-receiving bores of a barrel-type or "Ace" lock. The invention contemplates the grouping of springs in two or more equal rate categories. For example, a highly effective tamper-proof lock is attained when, in a seven tumbler-type lock, two of the springs are relatively strong and have equal spring rates, two other springs are relatively weak and have equal rates, while the three other springs have an intermediate strength and equal rates. By "relatively strong" and "relatively weak" is meant that the higher rate or strong springs have a resistance to compressional forces which is approximately twice the resistance to compressional forces possessed by the lower rate or weak springs. On this basis, it is manifest that the spring rate of the strong springs is approximately 50% more than the spring rate of the intermediate strength springs and is approximately 100% more than the spring rate of the weak springs. Regardless of the particular method of attaining spring rate differentials, an effective tamper-proof lock will result if any one given spring has at least twice the spring rate of the weakest spring in the series.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. A tamper-proof axial tumbler lock of the character described, and comprising a lock cylinder having an open front rim for insertion of a key therethrough, a front rotatable part and an annular sleeve-like rear stationary part disposed within said cylinder and presenting relatively slidable faces which meet each other on an interfacial plane normal to the axis of the cylinder, an annular series of longitudinally extending bores formed in said stationary part, arranged in circumferentially spaced relationship therearound and no less in number than four, a corresponding annular series of longitudinally extending bores formed in said rotatable part and similarly arranged therearound, said rotatable part being movable between a position wherein the respective bores of the two parts are in alignment and the lock is in its locked condition and a position wherein such bores are out of alignment and the lock is in its unlocked condition, a split tumbler for each pair of aligned bores including a driver pin slidable in the respective bore of the rotatable part and a follower pin slidable in the respective bore of the stationary part, and a helical spring disposed in each bore of the stationary part rearwardly of the associated follower pin and serving normally to urge the latter forwardly, certain of the springs being of substantially equal spring rate and at least one other of the springs having a spring rate of no less than twice the spring rate of each of said certain springs in order to render the lock more difficult to pick by use of a picking tool comprising a cylindrical shank shaped for insertion into the open front rim of the lock cylinder and provided in its outer periphery with an annular series of longitudinally extending open-ended grooves corresponding in number and position to the bores in the rotatable part of the lock and adapted upon insertion of the shank into said open front rim of the lock cylinder to register with the outer ends of the last mentioned bores, tumbler-engaging fingers corresponding in number to and longitudinally slidable in the grooves respectively, and means for frictionally holding the fingers in the various adjusted positions which they assume in their respective grooves in connection with normal use of the picking tool.

2. A tamper-proof axial tumbler lock of the character described, and comprising a lock cylinder having an open front rim for insertion of a key therethrough, a front rotatable part and an annular sleeve-like rear stationary part disposed within said cylinder and presenting relatively slidable faces which meet each other on an interfacial plane normal to the axis of the cylinder, an annular series of longitudinally extending bores formed in said stationary part, arranged in circumferentially spaced relationship therearound and no less in number than four, a corresponding annular series of longitudinally extending bores formed in said rotatable part and similarly arranged therearound, said rotatable part being movable between a position wherein the respective bores of the two parts are in alignment and the lock is in its locked condition and a position wherein such bores are out of alignment and the lock is in its unlocked condition, a split tumbler for each pair of aligned bores including a driver pin slidable in the respective bore of the rotatable part and a follower pin slidable in the respective bore of the stationary part, and a helical spring disposed in each bore of the stationary part rearwardly of the associated follower pin and serving normally to urge the latter forwardly, certain of the springs being intermediate strength springs having substantially the same spring rate, another of the springs being a weak spring having a spring rate appreciably less than the spring rate of the intermediate strength springs, and still another of the springs being a heavy spring having a spring rate appreciably greater than the spring rate of said intermediate strength springs in order to render the lock more difficult to pick by use of a picking tool comprising a cylindrical shank shaped for insertion into the open front rim of the lock cylinder and provided in its outer periphery with an annular series of longitudinally extending open-ended grooves corresponding in number and position to the bores in the rotatable part of the lock and adapted upon insertion of the shank into said open front rim of the lock cylinder to register with the outer ends of the last mentioned bores, tumbler-engaging fingers corresponding in number to and longitudinally slidable in the grooves respectively, and means for frictionally holding the fingers in the various adjusted positions which they assume in their respective grooves in connection with normal use of the picking tool.

3. A tamper-proof axial tumbler lock as set forth in claim 2 and in which the spring rate of the heavy spring is approximately twice that of the weak spring.

4. A tamper-proof axial tumbler lock cylinder having an open front rim for insertion of a key therethrough, a front rotatable part, and an annular sleeve-like rear stationary part disposed within said cylinder and presenting relatively slidable faces which meet each other on an interfacial plane normal to the axis of the cylinder, an annular series of seven longitudinally extending bores formed in said stationary part and arranged in circumferentially spaced relationship therearound, a corresponding annular series of longitudinally extending bores formed in said rotatable part and similarly arranged therearound, said rotatable part being movable between a position wherein the respective bores of the two parts are in alignment and the lock is in its locked condition and a position where such bores are out of alignment and the lock is in its unlocked condition, a split tumbler for each pair of aligned

bores including a driver pin tumbler slidable in the respective bore in the rotatable part and a follower pin slidable in the respective bore of the stationary part, and a helical spring disposed in each bore of the stationary part rearwardly of the associated follower pin and serving normally to urge the latter forwardly, three of the springs being intermediate strength springs having equal spring rates, two other of the springs being weak springs having spring rates that are equal but appreciably less than the spring rate of the intermediate strength springs, and the remaining two springs being strong springs having spring rates that are equal but appreciably greater than the spring rate of the intermediate strength springs in order to render the lock more difficult to pick by use of a picking tool comprising a cylindrical shank shaped for insertion into the open front rim of the lock cylinder and provided in its outer periphery with an annular series of longitudinally extending open-ended grooves corresponding in number and position to the bores in the rotatable part of the lock and adapted upon insertion of the shank into said open front rim of the lock cylinder to register with the outer

ends of the last mentioned bores, tumbler-engaging fingers corresponding in number to and longitudinally slidable in the grooves respectively, and means for frictionally holding the fingers in the various adjusted positions which they assume in their respective grooves in connection with normal use of the picking tool.

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