IZNITATION COMBINATION LOCK MECHANISM

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ABSTRACT OF THE DISCLOSURE

An ignition lock mechanism, which fits into the ignition lock housing now provided in automobiles, having axial elements which engage fingers attached to pushbuttons and upon depression of pushbuttons in proper sequence the movement of the axial elements unlock the mechanism so that the lock mechanism can freely rotate and hereby activate the ignition system through the ignition switch which cooperates with the lock mechanism.

Specification

This application is a continuation-in-part of my copending application Ser. No. 613,168, filed Feb. 1, 1967.

This invention relates to a combination lock mechanism utilized specifically to actuate automobile ignition switches without the need for keys and may also be utilized for automobile door and trunk locks. More specifically, a novel ignition combination lock mechanism which fits into the conventional ignition lock housing of an automobile, after removal of the key cylinder tumblers lock mechanism, wherein this novel mechanism utilizes axial members, in lieu of tumblers, which permits one to operate the ignition switch upon depressing buttons on the face of the lock mechanism in proper sequence.

Combination or permutation switches for automobile ignition systems are well known in the art and date back to the early part of this century. Such “switches” are exactly what their name connotes, namely that by performing the proper combination or permutation on levers or pushbuttons, electrical contacts or electrical circuits are closed which causes the automobile ignition cycle to commence. In order to utilize one of these switches, the wiring thereto has to be performed in the factory, or if it is to replace the conventional switch, extensive wiring has to be performed to complete the conversion. This can be a design expense if done at the factory, and/or a labor expense if done as a conversion. Similarly it presents a learning or an educational problem to the operator if there is a hard start where the operator is used to the “feel” of turning the switch, and releasing it if it does not start and turning it again until it does start. My automobile ignition combination lock mechanism has none of these disadvantages, and indeed has additional advantages over these prior systems. My system does not have levers or links connected to the pushbuttons which close electrical contacts or electrical circuits, my system utilizes the electrical circuitry and electrical ignition switch which is provided by the automobile manufacturer. What my system entails is to replace the mechanical lock which cooperates with the actual switch, with a mechanical combination lock mechanism which fits into the existing ignition lock housing and operates the electrical switch in the existing conventional manner. There is no extensive redesigning of the electrical system required with my invention, it is easily installed as original equipment in the factory, or is just as easily installed as an accessory item. My invention has the attractive feature wherein the operator need not carry his keys or have to worry about the loss of any car keys. Although this feature may seem to be one merely of convenience, the fact is that a recent survey conducted by our Justice Department (Department of Justice News Release, dated July 7, 1967), covering more than 4000 stolen automobiles showed that three out of every five of these stolen cars were left by their owners with keys in the ignition or on the ignition unlocked. It, therefore, seems that the feature of not having to utilize car keys is an extremely desirable one in present day conditions.

A further feature of my invention is that the lock mechanism is enclosed in a cylindrical housing which carries a series of axial elements for actuation by pushbuttons located on the face of the ignition lock. Proper depression of the right buttons in sequence causes incremental movement of said elements which disengages a key lug from engagement with a key way in the ignition lock housing so that the lock mechanism which is in engagement with the ignition is free to rotate. Rotation of the lock mechanism in turn rotates the ignition switch which initiates the ignition cycle of the internal combustion engine.

As a further feature, my invention prevents one not familiar with the combination from diagnosing the proper combination by means of automatically resetting the axial elements to its original position at any time the wrong button is pressed regardless of the number of increments the axial members have moved prior to depressing the wrong button. Those skilled in the art will appreciate that this novel feature will frustrate the attempts of one attempting to diagnose the proper combination by trial and error.

The more important features of my invention have been broadly outlined above in order that the more detailed description that follows may be better understood. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto.

The objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIGURE 1 shows a cross section of my ignition combination lock mechanism in the locked position.

FIGURE 2 shows a cross section of my ignition combination lock mechanism in the unlocked position.

FIGURE 3 shows an exploded view of an alternate series of axial elements which can be utilized by the lock mechanism.

Referring to the drawings which illustrate the preferred embodiments of the mechanism constructed in accordance with the present invention, FIGURE 1 shows the general arrangement of the ignition combination lock mechanism in the locked position and seated in the ignition lock housing 10. A knob 12 generally of cylindrical shape, has serrations 14, around its periphery at one end and six apertures 16 located in a circular pattern on its face and one larger aperture 18 at its center. All of these apertures 16 and 18 are shown to receive push button assemblies. Each pushbutton assembly which fits into apertures 16 consists of a pushbutton 20, a spring 22 and a finger 24 fixed between the pushbutton 20 and the shoulders 26 and 28 of the pushbutton 20 and abuts against shoulder 24 of the pushbutton at one end, and against seat 26 of the knob 12 at the other end. Shank 28 of pushbutton 20 passes through the opening of seat 26 and has a finger 30 attached to it by a screw 32 which engages the end of shank 28. It should be noted that finger 30 which is attached to shank 28 has a flat portion that extends beyond the opening of seat 26 which limits the movement of pushbutton 20 in the amount it extends beyond the face of knob 12.

Central aperture 18 receives a hollow pushbutton 32. Pushbutton 32 has a spring 34 abutting the bottom of its cupped portion 40, and normally contacts a cylindrical guide ring 36 around its outer rim which is located inside of knob 12. Guide ring 36 has six slots 38, which are equally spaced around its surface. These slots 38...
receive each finger 30 which is so designed that it has an inclined hook portion 31 to engage slot 38. The engagement of fingers 30 with slots 38 urge guide ring 36 to completely rotator push button 32.

Slightly fitted into cupped portion 40 of hollow push-button 32 is one end of spool 42. This end of spool 42 has a drilled out portion 44 which receives the other end of spring 34. Since the rimmed portion of button 32 abuts the inner face of knob 12, pushbutton 32 is limited in its movement towards the right. Therefore urges spool 42 towards the left. Affixed to spool 42 is the segment assembly 46. Segment assembly 46 comprises a support bushing 48 which engages spool 42, segments 50 which are interlocked about the periphery of bushing 48, two washers 54, which engage circumferential slots in spool 42 at each side of the end plates 52 to hold them stationary. Bushing 48 is dowelled to spool 42 by means of dowel pin 56 to keep bushing 48 rotatably stationary relative to spool 42 by engaging groove 90. Interlocked segments 50 are affixed to bushing 48 by means of dowel pin 57 for proper alignment of these segments relative to guide ring 36. In my embodiment there are six segments 50 which are interlocked axially along their sides. However, they may be made of six segments 50 which are ring-shaped as shown in FIG. 3 and interlocked with each other at points 60 to form hollow cylinder 62. In each of these segments 50 there is a slot 64 as shown in FIGURES 1 and 2 or a slot 66 as shown in FIGURE 3. In my embodiment slots 64 are laterally displaced a discrete distance from one segment to the next. It should be noted that each slot 64 is radially aligned with a given slot 38 on guide ring 36, although it is laterally displaced from these slots 38. Similarly each finger 30 is radially aligned with a given slot 38. The segments 50 and segment assembly 46 are urged towards the left since the assembly 46 is free to rotate. Spool 42 extends into lock casting 68 and its other end is slightly supported in recess 70 of lock casting 68. Lock casting 68 is similar in external geometry to a lock casting normally provided with the original equipment for tumblers locks in automobile ignition switches. Lock casting 68 is integrally affixed to knob 12 via an end flange plate 72. End flange plate 72 is affixed to knob 12 by means of screws 74, and brazed to lock casting 68 on rim 76. A rib 88 on flange plate 72 engages groove 90 on spool 42 to keep spool 42 from rotating relative to lock casting 68 and knob 12.

Lock casting 68 has a key lug 78 mounted in its central portion which extends beyond a portion of the surface of lock casting 68 and engages a keyway 108 on the ignition lock housing 10 when it is in the locked position. Key lug 78 is urged downward by springs 80 which are constrained on its top surface by a plate 82 which is integral with lock casting 68 and abuts against shoulders 84 of key lug 78 at its other end. Key lug 78 has two notches 86 located on its lower surface. Engaging these notches 86 are shoulders 91 on spool 42, which are cammed into and out of notches 86 as will be explained later.

The assembly of lock casting 68, and complete knob 12 being an integral part, along with spool 42 and segment assembly 46 mounted therein is inserted into ignition lock housing 10, which is provided as original equipment with the automobile, and locked in place in the following manner.

The complete assembly of lock casting 68 and knob 12 is inserted as far as it will go into the ignition housing 10. It will be stopped from being inserted all the way by ears 92 of the ignition lock housing 10 abutting the front face 88. The complete assembly is then rotated until ears 92 line up with slots 98 on the ignition lock housing 10. Lug 97 on the lock casting 68 is now engaging spring-loaded pin 96 which is mounted in the ignition lock housing 10. Further insertion of the complete assembly will depress pin 96, and allow ears 92 to slide past slots 98 until ears 92 abut against ridge 100 and seat in recess 102 on the lock casting. Further rotation of the complete assembly is stopped in direct contact with pin 96, and causes pin 96 to return to its original position in a recess located on either side of lug 97. The complete assembly is now locked into the ignition lock housing as shown in FIGURE 2, and can only be removed in the manner which shall be described below. FIGURE 1 shows the lock casting 68 as it is engaged in the ignition lock housing 10 before it is rotated to be "locked in."

It should be noted that when the lock casting 68 is "locked in" as described above, nose 104 which is irregularly shaped is engaged into a similarly shaped recess in the ignition switch 106. The complete ignition switch 106 is not shown here, but only a portion is shown for brevity and since nose 104 and recess in switch 106 are irregularly shaped, the rotation of lock casting 68, and thereby rotation of nose 104, similarly cause ignition switch 106 to rotate with it. The complete ignition switch and its associated wiring and contacts are not shown here, but it is a standard item and well known to those skilled in the art. It should also be noted that when the lock casting 68 is inserted into the ignition lock housing, the portion of key lug 78 which extends beyond the periphery of lock casting 68 is recessed to be flush with the lock casting surface, and is therefore in the unlocked position. In this unlocked position, key lug 78 is free of keyway 108 and therefore the lock casting is free to rotate. However, once the pushbutton 32 is depressed, the key lug 78 is cammed into the locked position and can only be unlocked in the manner which will be described below.

To remove the complete assembly the mechanism should be unlocked, as will be described, and the knob turned to the "Accessory" position. In this position pin 94 is spring urged against its head so that it contacts the end of guide ring 36, and is aligned with spring loaded pin 96 located in ignition lock housing 10. At this point slots 98 on lock casting 68 are aligned with ears 92 as shown in FIGURE 1 and by depressing pushbutton 32 it causes pin 94 to move pin 96 toward the left against the spring of pin 96. The knob 12 is now rotated slightly past the accessory position in a counterclockwise movement and pushbutton 32 is released. It is this slight rotation when pin 96 is depressed which allows lug 97 to rotate free of the recess and again abut pin 96, so that the complete assembly is now free to slide out.

The operation of my ignition combination lock mechanism for locking or unlocking will now be described and can best be observed by referring to FIGURES 1 and 2. FIGURE 1 shows the mechanism in the locked position which results in key lug 78 engaging keyway 108. This is due to the fact that shoulders 91 on spool 42 are not seated in notches 86 and the key lug is cammed upward by flat portions of shoulder 91 and the surface of spool 42. The segment assembly 46 is in the position shown, and in order to open the lock the segment assembly 46 will be moved towards the right, therefore also moving spool 42 against spring 34 until notches 86 on key lug 78 line up with shoulders 91 on spool 42. At this point springs 82 will urge key lug 78 downward until notches 86 seat on shoulders 91. Key lug 78 will then clear keyway 108 and the complete lock casting 68 will be unlocked free to rotate when the knob 12 is rotated. To move the segment assembly 46 towards the right to unlock the mechanism, one must depress pushbuttons 20 in proper sequence. On each of the six pushbuttons 20 are identifying marks in letters or numerals. Upon depressing the first pushbutton in proper sequence, the hooked portion 31 of finger 30 will engage its corresponding slot 64, and upon release of the pushbutton 20 just depressed, spring 22 will urge the pushbutton back to its original position. Since the hooked portion 31 of finger 30 engages a slot 64 of a segment 58 and finger 30 is affixed to the pushbutton 20, it will move itself and the whole segment as-
sembly 46 a distance equal to that of the movement of the pushbutton 20 in returning to its original position. It should be noted that all pushbuttons 20 shown are in their non depressed or original positions. Also it should be noted that finger 30 is made of a spring material and due to its geometry, hooked portion 31 is always urged downwards as indicated by the arrow. When the next pushbutton 20 is depressed in proper sequence, hooked portion 31 of finger 30 will again engage its corresponding slot 64 in a segment 58 and upon releasing pushbutton 20, the whole segment assembly will move an additional incremental distance. As the segment assembly starts to move after releasing the second pushbutton 20, the first finger lock actuation, without the aid of slot 64 due to the fact that the front end piece of hooked portion 31 will hit the end of the slot 64 and ride up on segment 58, as shown in the upper half of FIGURE 2. Similarly when the third pushbutton 20 is depressed in proper sequence and upon release the second finger 30 will be carried out of slot 64. Therefore, you always have control of the position of the segment assembly 46 as it moves itself and spool 42 against spring 34. When all the pushbuttons 20 have been pressed in proper sequence, the segment assembly 46 and therefore spool 42 has moved sufficiently against spring 34 so that notches 36 in key lug 78 are seated on shoulders 91 of spool 42. The mechanism is now unlocked and can be rotated thereby rotating ignition switch 106 to make electrical contacts and initiate the ignition cycle. Here we have used a three number or letter combination merely as an example. The number of numerals or letters required can be varied by construction, or the combination changed by removing the segments 58 from the knob 12 and rearranging them or inserting a new set of segments.

Above we have described how the mechanism is unlocked and have assumed that all the pushbuttons 20 were depressed in proper sequence. If at any time during the combination cycle the wrong pushbutton 20 is depressed, hooked portion 31 of finger 30 will ride on the surface of segment 58, and elbow portion 110 of finger 30 will abut the end of slot 38 on guide ring 36 and more guide ring 36 towards the left. Movement of guide ring 36 towards the left will cause finger 30 which is in engagement with a slot 64 out of the slot 64, thereby leaving segment assembly free of any urging by fingers 30 and the whole segment assembly 46 will move left to its original position by urging of spring 34. The mechanism, therefore, remains in the locked position and the whole combination sequence must, therefore, be repeated. This is an important feature if one not knowing the combination tries to open the lock by trial and error. The camming action of guide ring 36 on engaged finger 30 is performed by the right end of slot 38 abutting inclined portion 112 of engaged finger 30 and lifting the hooked portion 31 out of slot 64 as the guide ring 36 moves towards the left as shown in the lower portion of FIGURE 2.

When the mechanism is unlocked and one wishes to lock it after operating the automobile and the knob 12 is in the "off" position, one need only depress the center push buttons 33 which urges guide ring 36 towards the left which lifts the engaged finger 30 out of slot 64, as explained above. When the engaged finger 30 loses control of segment assembly 46, the spring 34 urges the spool towards the left along with the action of guide ring 36 and cams up key lug 78 into keyway 108 to lock the mechanism.

While I have described the structure and operation of a combination lock mechanism of the present invention in considerable detail as applied to ignition systems of automobiles for purposes of illustration, it will be understood that many of these details may be varied considerably and my combination lock mechanism may be utilized in ways other than ignition systems such as automobile door or trunk lock actuation, without departing from the spirit and principles of my invention.

I claim:

1. A combination lock mechanism comprising an ignition lock receptacle, a casing rotatably mounted in said ignition receptacle, a plurality of push buttons mounted on the face of said casing and each adapted to be depressed from a normal projected position to a fully depressed position and upon release to be returned to its initial projected position, a housing slidably mounted in said casing, a spool passing axially through said housing and affixed to said housing, biasing means urging said spool toward one end of said casing, a key mounted in said casing and cooperating with a keyway formed on the inner surface of said receptacle, means for sliding said housing and said spool against said biasing means and thereby causing said key to be disengaged from said keyway upon completion of depression of said pushbuttons in proper sequence.

2. A combination lock mechanism as defined in claim 1 wherein each of said pushbuttons has a finger attached to its end located in said casing.

3. A combination lock mechanism as defined in claim 2 wherein means for sliding said housing comprises a series of interlocked elements mounted on the surface of said housing and each element having an opening therein, and each opening cooperating with a corresponding finger upon depression of the proper pushbutton in proper sequence.

4. A combination lock mechanism as defined in claim 3 wherein the cooperation of a finger and an opening in one of said elements upon release of its corresponding pushbutton moves said elements and spool against said spool biasing means.

5. A combination lock mechanism as defined in claim 1 having additional means for resetting said spool and housing to their original position upon depression of a pushbutton in improper sequence.

6. A combination ignition lock mechanism comprising a stationary automobile ignition receptacle, a casing rotatably mounted in said ignition receptacle, means for locking said casing against rotation, a plurality of pushbuttons mounted on the face of said casing, a housing slidably mounted in said casing, a spool passing axially through said housing, and affixed to said housing, biasing means urging said spool towards one end of said casing, an ignition switch engaging one end of said casing, means for unlocking said casing, upon depression of the pushbuttons in proper sequence so that said casing may freely rotate and thereby rotate said ignition switch.

7. A combination ignition lock mechanism as defined in claim 6 wherein means for unlocking said casing comprises a plurality of elements mounted on the periphery of said housing, camming means formed in one end of said spool, a key mounted in said casing which is biased in a direction toward said camming means, and a keyway formed on the inner surface of said ignition receptacle and aligned with said key.

8. A combination ignition lock mechanism as defined in claim 7 wherein said pushbuttons have fingers attached to the ends of said pushbuttons located inside of said casing, and each of said pushbuttons are adapted to be depressed from a normal projected position to a fully depressed position and upon release to be returned to its initial projected position.

9. A combination ignition lock mechanism as defined in claim 8 wherein each of said elements are interlocked and each has an opening therein which cooperate with at least one of said fingers upon depression of the proper pushbuttons, and said elements move a given distance and thereby move said housing and said spool the same given distance against the action of said spool biasing means.

10. A combination ignition lock mechanism as defined in claim 9 wherein completion of depressing the pushbuttons in proper sequence moves said spool to a position where said key which was biased in a direction toward
said camming means is dropped out of engagement with said keyway and is urged to engage said camming means.

11. A combination ignition lock mechanism as defined in claim 10 wherein said means for locking the casing against rotation comprises a pushbutton mounted on the face of said casing and a finger lifting mechanism slidably mounted in said casing and abutting said pushbutton, whereby upon depression of said pushbutton said finger lifting mechanism disengages the finger retaining said housing and said spool thereby allowing said spool biasing means to urge said spool to cam up said key to engage the keyway on said ignition receptacle.

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