July 16, 1929. S. F. DE CASTRO É IZNAGA 1,720,838

COMBINATION LOCK AND KEY

Filed March 5, 1923 4 Sheets-Sheet 1

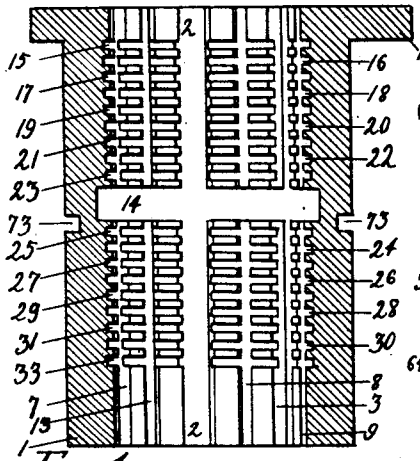


Fig. 1.

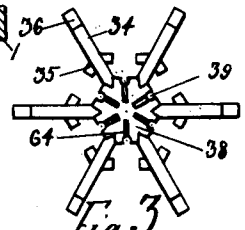


Fig. 3.

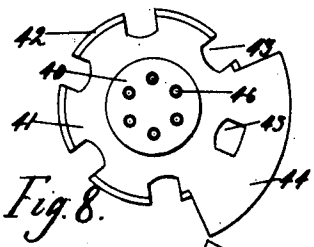


Fig. 8.

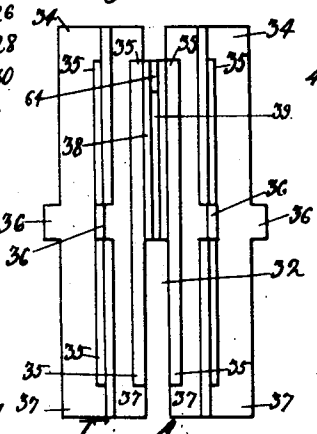


Fig. 4.

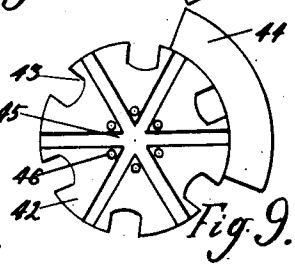


Fig. 9.

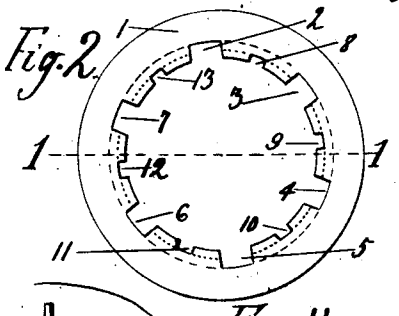


Fig. 2.

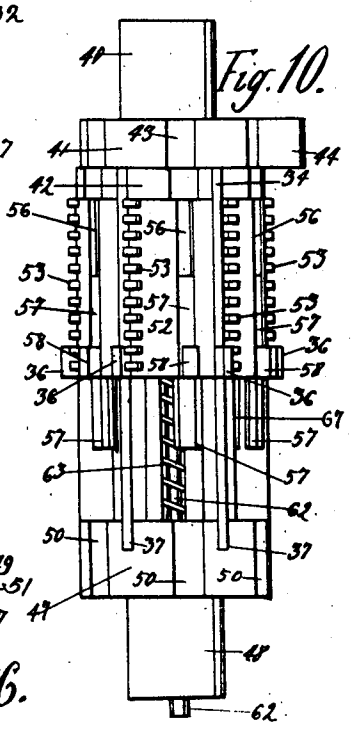


Fig. 10.

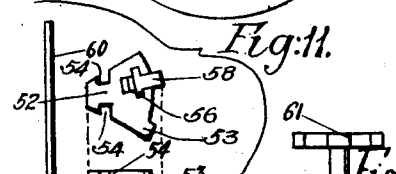


Fig. 11.

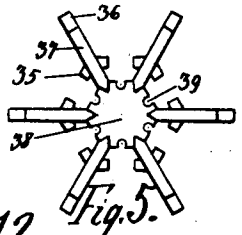


Fig. 5.

Fig. 13.

Fig. 12.

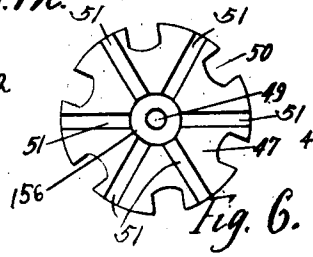


Fig. 6.

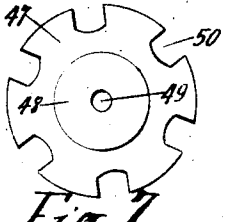


Fig. 7.

Witnesses:

Inventor:

Sagra de Castro Iznaga

July 16, 1929. S. F. DE CASTRO É IZNAGA 1,720,838

COMBINATION LOCK AND KEY

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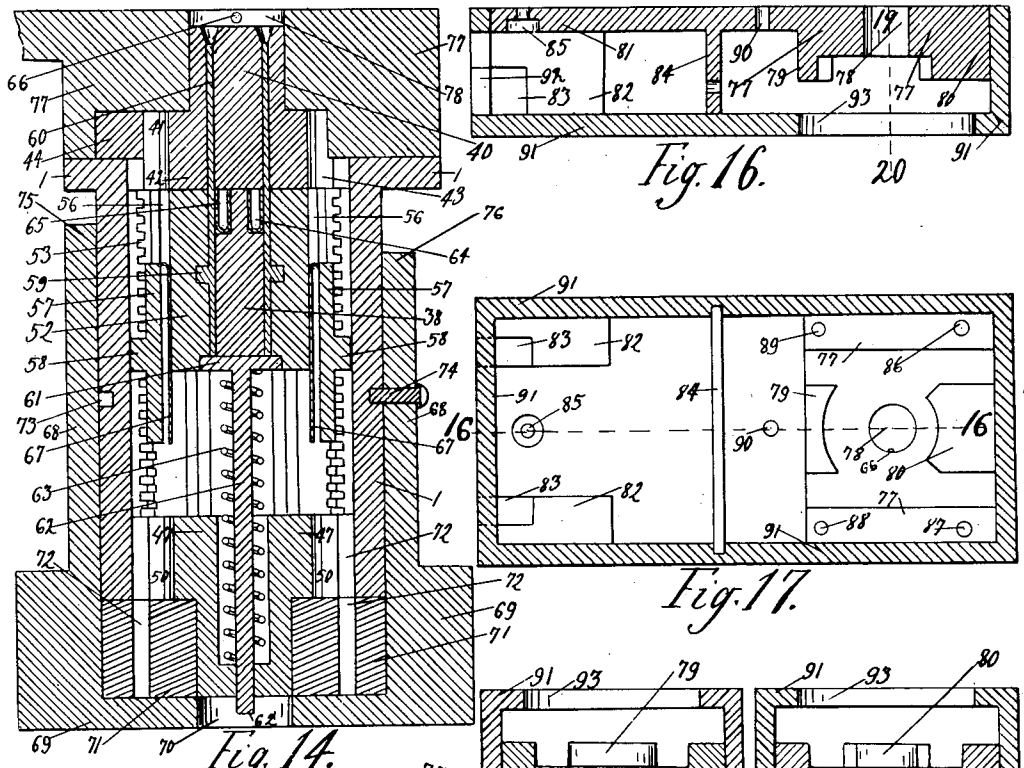


Fig. 16.

Fig. 17.

Fig. 14.

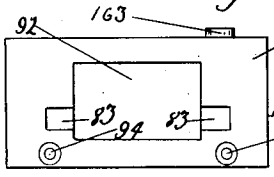


Fig. 18.

Fig. 19.

Fig. 20.

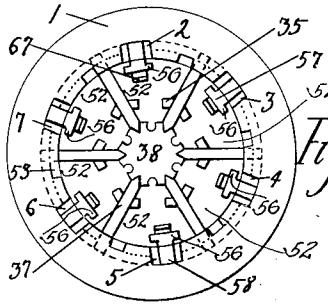


Fig. 15.

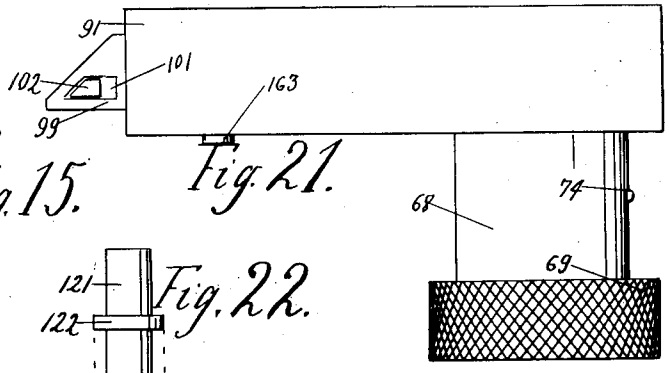


Fig. 21.

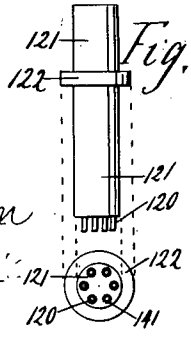


Fig. 22.

Witnesses:

Manuel Wilkinson

Benedicto Argüelles

Inventor:

Sergio de Castro Iznaga

July 16, 1929. S. F. DE CASTRO É IZNAGA 1,720,838

COMBINATION LOCK AND KEY

Filed March 5, 1923 4 Sheets-Sheet 3

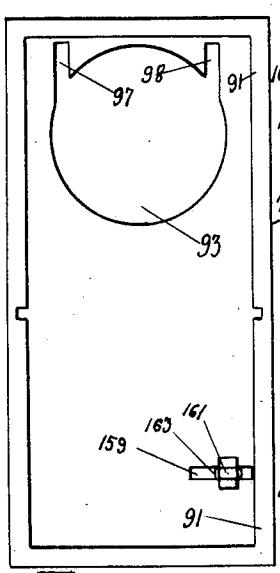


Fig. 27.

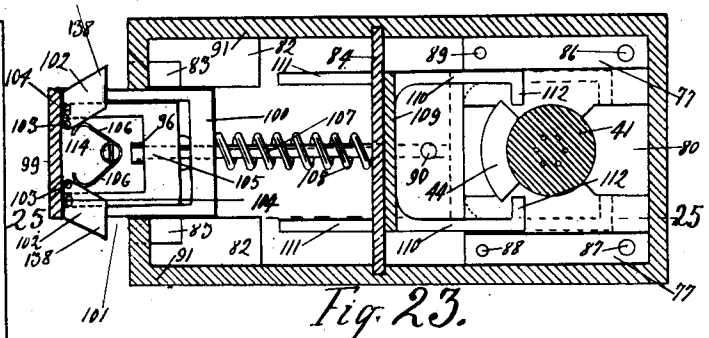


Fig. 23.

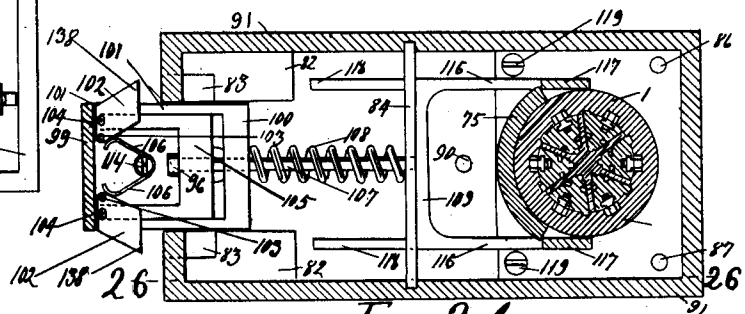


Fig. 24.

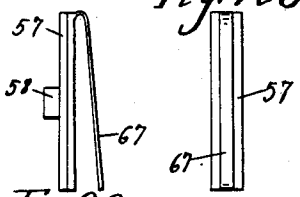


Fig. 28.

Fig. 29.

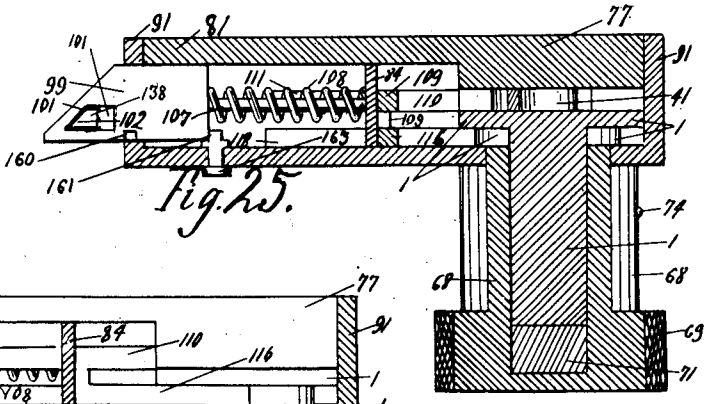


Fig. 25.

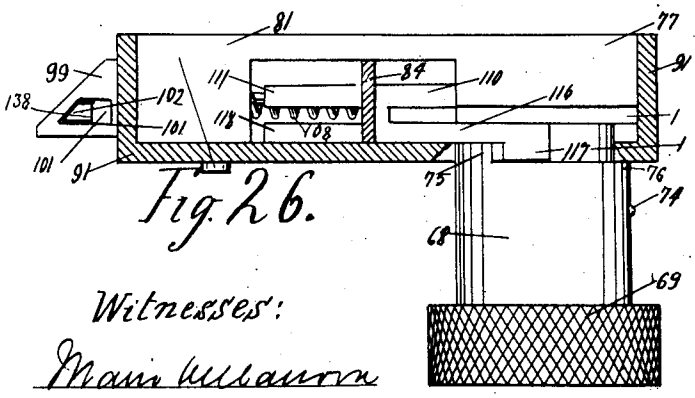


Fig. 26.

Witnesses:

Mario Villaverde

Bartolito Pigno

Inventor:

Sergio de Castro Iznaga

July 16, 1929. S. F. DE CASTRO É IZNAGA 1,720,838

COMBINATION LOCK AND KEY

Filed March 5, 1923 4 Sheets-Sheet 4

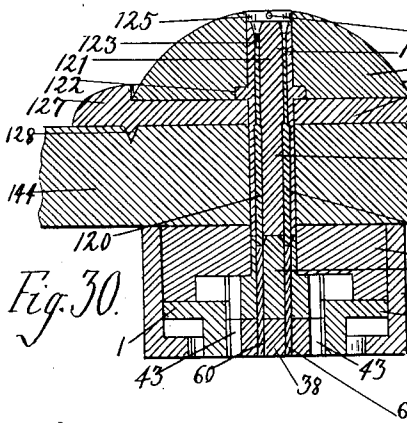


Fig. 30.

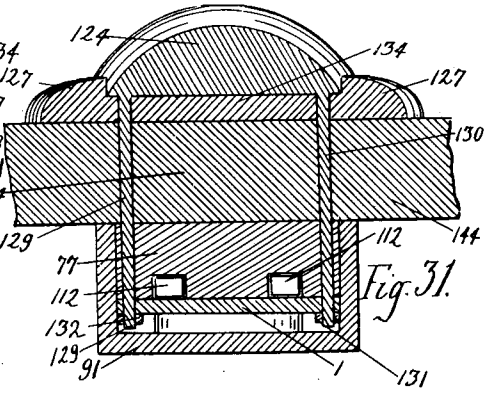


Fig. 31.

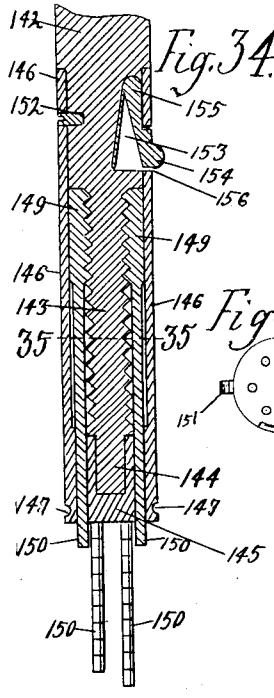


Fig. 34.

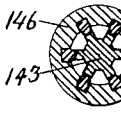


Fig. 35.

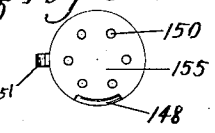


Fig. 36.

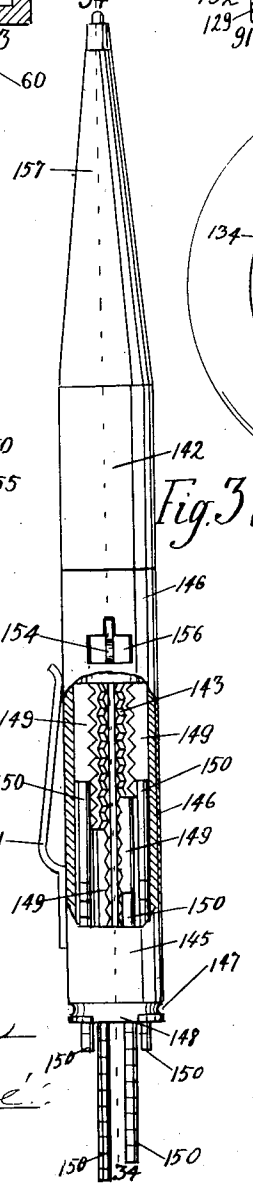


Fig. 37.

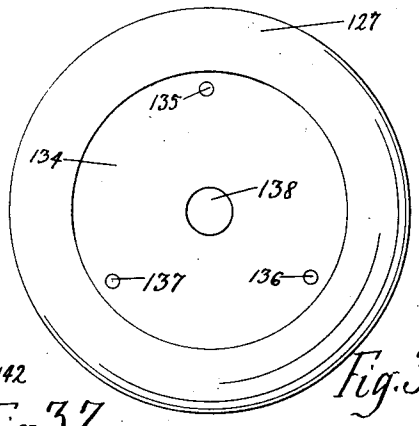


Fig. 32.

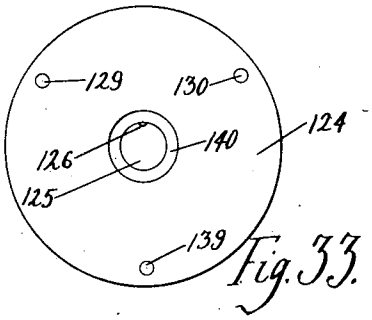


Fig. 33.

Witnesses:

Mario Milanesio

Bandrio Prigué

Inventor:

Sergio de Castro Iznaga

Patented July 16, 1929. 1,720,838

UNITED STATES PATENT OFFICE.

SERGIO FAUSTINO DE CASTRO É IZNAGA, OF HABANA, CUBA; JUAN DE CASTRO Y PLANS AND CARMEN IZNAGA Y RUIZ HEIRS OF SAID SERGIO FAUSTINO DE CASTRO É IZNAGA, DECEASED.

COMBINATION LOCK AND KEY.

Application filed March 5, 1923. Serial No. 623,074.

My invention relates to combination locks in which the key, after conveying the wards to their proper positions, turns the central body of the lock to operate the locking bolt, and an object is to provide a lock of this character which may be used for locking purposes in general and which cannot be felt out and brought into unlocking position by persons who do not know the combination. An object of my invention is to provide a lock capable of a very large number of combinations, which can be easily changed without taking apart the members of the lock when the right combination is known. Another object of my invention is to provide a key suitable to operate any lock of this kind whenever its combination is known. Another object of my invention is to provide a latch or locking bolt which cannot be unlocked by thrusting an edge against its bevel.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and the novel features embodied in my inventive idea will be particularly pointed out in the claims.

In the accompanying drawings, which illustrate the application of my invention in one form—

Figure 1 is an enlarged view, in cross-section through the tubular casing on the line 1—1 of Fig. 2 showing the longitudinal and circular grooves of its inner face. Figure 2 is an enlarged plan view of the tubular casing for the turnable body. Figure 3 is an enlarged plan view of the skeleton of the turnable body. Figure 4 is an enlarged side view of the skeleton of the turnable body. Figure 5 shows, on an enlarged scale, the skeleton of the turnable body seen from the end opposed to that shown in Fig. 3. Figure 6 shows on an enlarged scale the butt-piece of the turnable body seen from its inner face, showing the slots which receive one end of the skeleton and the bore to lodge a coil-spring. Figure 7 shows on an enlarged scale the same butt-piece as Fig 6, but seen from its outer end. Figure 8 shows on an enlarged scale the other butt-piece of the turnable body, seen from its outer side to show the projecting quadrant that operates the sliding bolt. Figure 9 shows on an enlarged scale the same butt-piece as Fig. 8, but seen from its inner side, showing the slots which receive the other end of the skeleton of the turnable body. Figure 10 is an enlarged view of the turnable body put together. Figure 11 shows on an enlarged scale one of the sliding sectors which carry the adjustable wards and also shows the rod that serves to push said sector. Figure 12 is an enlarged side view of the piece which pushes out the sliding sectors of the turnable body. Figure 13 is an enlarged view of the push-piece shown in Fig. 12, seen from its tail. Figure 14 is an enlarged cross-sectional view of the entire lock through the middle line of the turnable body. Figure 15 is an enlarged plan view of the turnable body, within its casing, minus the butt-piece. Figure 16 is a longitudinal section of the box for the sliding bolt, through the line 16—16 of Fig. 17. Figure 17 is a plan view of the frame for the sliding bolt, after the removal of the outer portion of its lid. Figure 18 is a front view of the lid of the box for the sliding bolt. Figures 19 and 20 are cross-sectional views of the box for the sliding bolt on the line 19—20 of Fig. 16. Figure 21 is a side view of the lock. Figure 22 shows in front and plan projections the additional piece which is passed through the leaf of the door, and constitutes the key-hole for the lock. Figure 23 is a top view of the sliding bolt, within its frame, after the removal of the upper portion of the lid, showing in section the lower portion of the butt-piece of the turnable body. Figure 24 represents a top view of the sliding bolt and its box, showing in section a portion of the turnable body and its casing. Figure 25 is a sectional view of the lock through the line 25—25 of Fig. 23. Figure 26 is a sectional view of the lock through the line 26—26 of Fig. 24. Figure 27 is a plan view of the inner side of the lid of the box of the sliding bolt. Figure 28 is an enlarged view of one of the sliding pieces which carry the adjustable wards. Figure 29 is a side view of the piece shown in Fig. 28, on the same scale. Figure 30 shows a cross-section through the middle line of the additional pieces that form the key-hole, a portion of the leaf of the door, and the box of the sliding bolt. Figure 31 is a cross-section of the additional pieces that form the key-hole, showing how they are anchored by bolts and nuts to the box of the sliding bolt, through the leaf of the door. Figure 32 is a front view of the protecting disc minus the cap. Figure 33 shows the cap of the key-hole

seen from its inner face. Figure 34 is an enlarged sectional view of the combination key on the line 34—34 of Fig. 37. Figure 35 is an enlarged cross-sectional view of the combination key on the line 35—35 of Fig. 34. Figure 36 is an enlarged view of the combination key seen from its operating end, and Figure 37 is an enlarged view of the entire combination key presenting a portion removed to show its inner disposition.

Similar numerals refer to similar parts throughout the several views.

The tubular casing 1 and the lock plate 77—81 constitute the framework of the lock. The inner face of the tubular casing 1, (Figs. 1 and 2), is provided with a number of equidistant longitudinal grooves 2, 3, 4, 5, 6 and 7; and between them, with narrower and less deep ones, 8, 9, 10, 11, 12, and 13. It also has parallel circular grooves, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 33 forming two groups of nine grooves separated by a wider and deeper one, 14, whose width is exactly four times the width of one of the other circular grooves.

The skeleton 38 of the turnable body, (Figs. 3, 4, and 5), has a number of radial partitions 34—37 provided each with a projecting tooth 36 in the middle of the outer edge, and with guide-strips 35 on both faces.

The core of the skeleton 38 presents cylindrical grooves 39 in the corners formed between the radial partitions 34—37. The lower portion of the skeleton 38 from the line of the projecting teeth 36 is removed to provide room for a push piece 61—62 and its coil-spring 63. The core of the skeleton 38 is also provided with small gaps 64 at the ends of the grooves 39 suitable for lodging U-springs 65, (Fig. 14).

The butt-piece, or cam rollback, that operates the sliding bolt comprises three superposed cylindrical portions of different diameters, 40, 41 and 42, (Figs. 8, 9, 10, and 14). It is provided with longitudinal grooves 43 cut in both portions 41 and 42. The portion 41 is provided with a projecting quadrant 44. The inner face of the portion 42 has radial slots 45, adapted to receive the ends 34 of the radial partitions of the skeleton 38. The butt-piece 40—41—42 presents around its axis a number of drillings 46 which correspond with the cylindrical grooves 39 of the skeleton 38.

The other butt-piece, (Figs. 6, 7, 10, and 14) is constituted by two superposed cylindrical portions, 47 and 48, of different diameters. The portion 47 has a number of grooves 50 and is provided on its inner surface with radial grooves 51 suitable to receive the ends 37 of the radial partitions of the skeleton 38. It has also a central bore 156 which serves to lodge the coil-spring 63 and a drill 49 wherethrough passes the tail 62 of the push-piece 61—62.

The sliding sectors (Figs. 10, 11, 14, and 15) are prismatical pieces 52 provided each on its curved face with a row of teeth 53 and sliding in the longitudinal grooves 8, 9, 10, 11, 12, and 13 of the casing 1 and rotate through the parallel circular grooves 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 33 of the same casing 1. Each sector 52 has two slots 54 one on each face; and a cross-shaped groove opening into the curved face, 56, (Figs. 10, 14, and 15), adapted to receive the sliding piece which bears the adjustable ward. (Figs. 10, 11, 14, 15, and specially 28 and 29). These sliding pieces 57 are of T-shaped cross-section and are provided with a catch or spring 67 which acts like a brake bearing against the bottom of the groove 56 to prevent the falling out of the piece 57. Each of said pieces 57 bears a projecting tooth 58 which constitutes one of the adjusting wards of the lock.

A rod 60, which slides through the groove 39 has a lateral projection 59 that fits into the gap 55 made in the inner face of the piece 52.

The push piece, (Figs. 12, 13 and 14), is constituted by a star-shaped head 61 and a rod 62. The head 61 passes by the space 32 of the skeleton 38 of the turnable body, (Figs. 4, 10 and 14). The rod 62 passes through the central drill 49 of the butt-piece 48.

A coil-spring 63, (Figs. 10 and 14), is lodged in the bore 156, (Figs. 6 and 14) bearing thereagainst and against the head 61 which pushes the ends 157 of the sliding sectors 52.

The U-springs 65, lodged in the gaps 64 of the skeleton 38, (Fig. 14), press the rods 60 acting as brakes to prevent the falling out of the sliding sectors 52.

66 is a button that serves to hold the key when the bore 78 is used as a key-hole, that is, when the lock is adapted to a very thin door which does not permit the use of the additional pieces which constitute the outer key-hole.

A collar 71 covers the butt-piece 47—48 of the turnable body and the outer end of its casing 1.

The casing 1 is covered by an outer casing 68 whose head 69 serves to slide the locking bolt into unlocking position by the inner side of the door. This outer casing is held in place by a screw 74, (Figs. 14, 21, 25, and 26) whose point plays into a groove 73 all around the outer face of the tubular casing 1. The knob 69 has a central bore 70 therethrough whereby the tail 62 may pass when pushed by the sliding sectors 52. The collar 71 is provided with a number of passages 72 which coincide with the longitudinal grooves 2, 3, 4, 5, 6, and 7 of the tubular casing. (Figs. 14 and 15).

About a third, 75, of the inner rim of the outer casing 68 is longer than the remaining two-thirds 76. (Figs. 14, 24, 25, and 26.)

The box for the sliding locking bolt con-

sists of a rectangular plate 77—81 (Figs. 16, 17, 18, and 19; also Figs. 14, 23, 24, 25, 26, 30, and 31). The portion 77 is thicker than the rest of the plate. A bore 78 serves as socket and journal bearing for the end 40 of the butt-piece of the turnable body, while the portion 41 and its projecting quadrant 44 fill the space between the guide 79 and the stop 80, (Fig. 23). The portion 81 has two upright blocks 82 at either sides of the sliding bolt. The plate 77—81 is provided with an upright cross-partition 84, and it has six drillings 85, 86, 87, 88, 89, and 90.

This plate 77—81 is covered by a lid 91, (specially shown in Fig. 27), provided with a circular gap 93 and two slots 97 and 98 communicating with said gap 93. It also has another slot 159 adapted to receive a small latch which may be slidden therein. The lid 91 may be secured to the plate 77—81 by means of screws through drillings as 94 and 95.

The sliding locking bolt, (Figs. 21, 23, 24, 25, and 26), is a parallelepipedal piece 99—100, with a bevel corner, as shown in the drawings. It is provided with two catching pieces or catches 102 suitably pivoted to the portion of the bolt which appears removed in the drawings. (Figs. 23 and 25.) Said catching pieces 102 are also pivoted to a cross-piece 105, which can slide within a mortise cut in the body of the bolt deeper than that lodging the catching pieces. The catching ends 138 of the catching pieces 102, get out through lateral outlets in the body of the sliding bolt pressed by a spring 106 bearing against both catching-pieces 102; and secured to the body of the sliding bolt by a screw 114.

A rod 107 passes loosely through suitable bores in the cross-piece 105, the rear part 100 of the sliding bolt and the cross-partition 84. The end of the rod 107 is firmly secured to the center of a cross-piece 109. Two pairs of parallel bars 110—111 and 116—118 slidable through suitable passages made in the cross-partition 84, are fastened to the ends of the cross-piece 109, forming with it two superposed H's. (Figs. 23 and 24.) The ends 112 of both bars 110 are bent in at right angle to said bars 110. The ends of both bars 116 are bent up forming the projecting parts 117 which may pass through the gap 93 and respectively, through the slots 97 and 98 of the lid 91, (Figs. 24, 26 and 27).

The butt-piece 41, (Fig. 23), can make half a revolution, either to the right or to the left, till the projecting quadrant 44 reaches the stop 80. While moving the quadrant 44 pushes before it one of the ends 112 of the bars 110—117 pulling thereby the cross-piece 109 and the rod 107 whose head 96 will pull the cross-piece 105 which, through the pivots 104, will cause the partial rotation of the catching-pieces 102 on their other pivots 103 overpowering the spring 106 and bringing in the ends 138 into the body of the sliding bolt 99—100. When the cross-piece 105 reaches the rear part 100 of the sliding bolt 99—100 pulls against it and overpowering the coil spring 108 causes the sliding bolt 99—100 to enter the box between the blocks 82.

When the butt-piece 44 turns back releases the end 112 of one of the bars 110—111. The coil-spring 108 reacts pushing against the rear part 100 of the sliding bolt and causing it to get out through the front gap 96 of the lid 91 of the box. Then the spring 106 will push against the catching-pieces 102 and cause their catching ends 138 to emerge through the side outlets 101 of the sliding bolt.

When the knob 69, (Figs. 24 and 26), is turned, either to the right or to the left the portion 75 of the outer casing 68 pushes either of the projecting parts 117 of one of the bars 116—118 causing thereby the pulling of the cross-piece 109 and the rod 107.

Since the device presented is a spring-lock, when the door is closed the staple or keeper presses against the bevel of the sliding bolt 99—100 and causes it to enter into its box, between the blocks 82, overpowering the coil-spring 108. During this motion of the sliding bolt, the ends 138 of the catching-pieces 102 enter into the mortises 83 made in each of the blocks 82. When the end 99 of the sliding bolt is exactly in front of the gap of the staple, the coil-spring 108 reacts causing the sliding bolt to enter into the staple. Then the rim of the keeper presses in the bevel edges of the catching-pieces 102 causing their ends 138 to disappear into the body of the bolt as it is entering into the staple, but as soon as it is within the staple the spring 106 reacts and again brings out the ends 138 into catching position, so that the sliding bolt cannot be released from its locking position by other means than by pulling the rod 107.

The lock is fastened to the leaf of the door by means of screws passing through proper drilling as 85, 88, and 89, (Fig. 17).

As the lock is placed on the inner side of the door, an additional piece or extension 121, (Fig. 22) is passed through a bore in the wood of the door 133. A socket constituted by two pieces, a round plate 127, (Figs. 30, 31 and 32), and a cap 124. The round plate 127 is provided on its inner face with points, as 128, which are drawn into the wood of the door to prevent any possible rotation of the plate 127. The cap 124 is provided with bolts as 129, 130 and 139, (Figs. 31 and 33), which pass through suitable drillings as 135, 136 and 137 in the central portion 34 of the round plate 127, the wood of the door 133, and suitable drillings as 86, 87 and 90 in the plate 77–81 of the lock, (Figs. 17 and 23), and are secured by nuts, as 131, 132, (Fig. 31). The exten-

sion 121 is provided with a rim 122 which is lodged into a suitable case 140, made in the inner face of the cap 124, (Fig. 33). The extension 121 does not fill completely the bore 125 of the cap 124, but leaves a little space, as shown in Fig. 30, which may be used as keyhole and is provided with a button 126.

The extension 121 has a number of drillings around its axis. The portions of said drillings comprised within the socket 124—134 are of lesser caliber than the portions of said drillings comprised within the wood of the door 133, which are of the same diameter as the drillings 46 of the butt-piece 40, with which they coincide, so that the ends of the rods 120 enter into said drillings 46 and touch the ends of the rods 60. The portions 123 of the rods 120 are of less diameter than the portions 120 of said rods.

The key, (Figs. 34, 35, 36 and 37), is formed as a stick 142 which may be a penholder at its end 157 as shown in Fig. 37. Said stick 142 has a stem 143 provided with a number of rows of triangular teeth, adapted to receive the teeth of some toothed bars 149. The end 144 of the stem 143 is cylindrical and enters into a proper bore made in the center of the socket 145 which form an entire piece with the tubular casing 146. The toothed bars 149 are provided with rods 150 passing through suitable drillings made in the socket 145, (Figs. 34 and 36), around the stem 144.

The tubular case 146 is provided with longitudinal grooves wherethrough the back of the toothed bars 149 can slide, as shown in Fig. 35.

If the tubular case 146 is held and the stick 142 is turned one twelfth of a turn, either to the right or to the left, the teeth of the stem 143 will let go the teeth of the toothed bars 149 and therefore these latter may be slid through their respective grooves in the tubular case 146. The head of a screw 152 set into the side of the stick 142 can slide through a small groove made in the tubular case 146, (Fig. 34). A spring fastener 141 is lodged in a suitable mortise 153, made in the side of the stick 142. The spring tongue 155 presses against the bottom of the mortise 153, causing the round end 154 of the fastener 141 to appear through a gap 156 made in the tubular case 146, while the edge of the fastener 141 may enter into a slot communicating with the upper end of the gap 156 exactly at its middle line.

All the rods 150 are of the same length and are provided with equidistant marks to indicate in what teeth of the stem 142 the respective toothed bars 149 are positioned.

The socket 145 is provided with a groove 147 which has about one sixth of its outer rim removed, as shown in 148.

A hook 151 attached to the tubular case 146 serves to hold the key in the edge of the pocket and also as a lever when the key is used.

The operation of the device is as follows:

If a thin rod or wire is inserted through one of the drillings 46 of the butt-piece 40 and pressed against the end of the rod 60, (Figs. 8, 10 and 14), said rod 60, by its projection 59, will convey in the corresponding sliding sector 52, pushing the head 61 and overpowering the coil-spring 63 press said coil-spring into the bore 156 of the butt-piece 47—48 as far as the length of the inserted wire will permit. Then when the wire is pulled out the coil-spring 63 reacts and pushes back the head 61 together with the sliding sector 52 and the rod 60 to their former position. If all the rods 60 were pushed in, by inserting wires of different length through the drilling 46, the sectors 52 corresponding to the longer wires would go in farther pushing the head 61 before them while those corresponding to the shorter wires would go in less far being left behind, but then the U-springs 65, acting as brakes against the rods 60, will prevent the falling down of said sliding sectors 52.

As the sliding sectors 52 go sliding in, or out, their teeth 53 pass respectively through the longitudinal grooves 8, 9, 10, 11, 12 and 13 of the casing 1; while the respective adjustable wards 58 pass through the wider and deeper longitudinal grooves 2, 3, 4, 5, 6 and 7 of the same casing 1.

If all the adjustable wards 58 have the same relative position with regard to their respective sector 52, as shown in Fig. 10 and the central body of the lock is turned to the right or to the left nine of the teeth 53 of each sector 52 will pass through the corresponding parallel grooves 15, 16, 17, 18, 19, 20, 21, 22, and 23, while the two remaining teeth of each row 53 together with the adjustable wards 58 will pass through the wider and deeper central groove 14 of the casing 1. But if any of the adjustable wards 58 were in a different position with regard to the corresponding sector 52, it would prevent the turning of the central body, then it would be necessary to push in the corresponding rod 60 until said adjustable ward 58 would reach the level of the central groove 14. Now, if each of the sliding sectors 52 has its adjustable wards 58 in different relative position, it would be necessary to push in the rods 60 corresponding to the several sectors 52 more or less according to the relative position of their respective adjustable ward 58 in order that all adjustable wards 58 be at the level of the central groove 14.

Supposing that all the adjustable wards have been brought to the level of the central groove 14 or that they have the position shown in Fig. 10, and therefore that the central body can turn to the right or to the left and actually is turned one twelfth of a turn, the rows of teeth 53 of every sector 52 will be in line with one of the wider longitudinal

grooves 2, 3, 4, 5, 6, and 7, while the adjustable wards 58 will be within the central groove 14 just in line with the less deep longitudinal grooves 8, 9, 10, 11, 12, and 13 being therefore held within the deep groove 14, because the adjustable wards 58 are longer than the depth of the grooves 8, 9, 10, 11, 12, and 13. If in this position the sectors 52 were slidden in or out their relative position with relation to their corresponding adjustable wards 58 would be changed.

As each sliding sector 52 has nine teeth that correspond to the nine parallel grooves 15, 16, 17, 18, 19, 20, 21, and 22, and 23 of the casing 1, the other two teeth of their respective row falling into the wider central groove 14; there will be ten different positions for every adjustable ward 58 in relation to the corresponding sliding sector 52; and as in the present construction, shown in the drawings, there are six of such sliding sectors 52; nine hundred ninety nine thousand nine hundred and ninety nine combinations will be possible for this lock.

As said hereinbefore, the length of the rods 150 of the key, (Figs. 34 and 37), may be set at will, helped by the marks cut in said rods 150—which correspond to the ten different lengths required by the ten different relative positions of the adjustable wards 58 with the sliding sector 52. These lengths being easily remembered by the ten numerals 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0.

Starting at any of the six wires 150, for instance the one in line with the hook 51, the combinations from 000000 to 999999 can be represented.

When all the adjustable wards 58 are in the position shown in Fig. 10 the lock has the combination 000000, or no combination at all and its central body can turn to either side.

When all the toothed bars 149 are in the upper end of the stem 143 and only a small portion of the wires 150 emerge from the socket 145 the key has the combination 000000. When all the toothed bars 149 are in the lower end of the stem 143 and the wires 150 emerge the most from the socket 145, the key has the combination 999999.

To insert the key in the key-hole 125 of the lock, (Fig. 30), the wire 150 in line with the hook 151 of the key is introduced into the drilling 141, (Fig. 22) of the extension 121, more to the right hand so that the button 126 passes by the middle of the portion 148 into the groove 147 of the socket 145 of the key. When one twelfth of a turn is given to the key to either side, the button 126 enters into the groove 147 and prevents the falling out of the key.

When the lock and the key have the same combination, the key can unlock the lock, because, when inserted into the key-hole 125 the wires 150 entering through the drillings 141 press the outer ends 123 of the rods 120—123 while the other ends 120 press in the ends of the rods 60 causing thereby the sliding in of the sectors 52, bringing their respective adjustable wards 58 to the level of the central groove 14, wherethrough they will pass when the key is turned to the right or to the left, causing the rotation of the turnable body of the lock and thereby the quadrant 44 of the butt-piece 40 to push one of the ends 112 of the bars 110—111 and thus, to pull them, the cross-piece 109, the rod 107, whose head 96 pulls the cross-piece 105 causing the partial turn of the catching-pieces 102 on their pivots 103 and the disappearance of their catching ends 138 into the body of the sliding bolt 99—100 and when the cross-piece 105 reaches the rear part 100 of the bolt 99—100 conveys it through the gap 92 of the lid 91 into the box between the blocks 82, overpowering the coil-spring 108; unlocking the lock.

If the lock has a combination, for instance 104792 and the key has a different combination, as 305781, when the key is inserted into the key-hole 125 the sliding sector 52 corresponding to the first rod 60 pushed by the first wire 150 of the key will go in only as far as the groove 16, but as the corresponding adjustable ward 58 is set for 3, it will not reach the level of the central groove 14 and therefore will prevent the turning of the turnable body of the lock. The second wire 150 of the key, set in 0, will not push the corresponding rod 60 and the sector 52 whereby its adjustable ward 58 will remain in line with the central groove 14. The third wire 150 of the key, which is set in 4, will cause the corresponding sliding sector 52 to go in as far as the groove 18, but as its adjustable ward 58 is set for 5, said ward will not reach exactly the line of the central groove 14 and only the inner half of said ward will be in line with the groove 14 and therefore it cannot enter thereinto. The fourth wire 150 of the key which is set for 7 will cause the corresponding sliding sector 52 to go in as far as the groove 21, and as its adjustable ward is set for 7 too, it will fall into line with the central groove 14. The fifth wire 150 of the key which is set for 9 will cause the corresponding sliding sector 52 to go in as far as the groove 23, but as its ward 58 is set only for 8, it will go beyond the line of the central groove 14, preventing therefore the turning of the turnable body of the lock. Finally the sixth wire 150 of the key, which is set for 2, will cause the corresponding sliding sector 52 to go in as far as the groove 17, but as its adjustable ward 58 is set for 1, it will pass far beyond the level of the central groove 14, preventing therefore the turning of the turnable body.

To put a combination to the lock when it has the 000000; the sliding bolt 99—100 is put into unlocking position and held so by

sliding the end 161 of the small latch 163 into the mortise 160 of the locking bolt 99—100; then with the key set for 000000, a twelfth of a turn is given to the turnable body of the lock, either to the right or to the left and then the key is withdrawn to set it for the desired combination, and inserted again into the key-hole, whereby, as the adjustable wards 58 are held within the central groove 14 and the row of teeth of the sliding sectors 52 are in line with the longitudinal grooves 2, 3, 4, 5, 6, and 7; when the key is pushed in the wires 150 cause the going in of the sectors 52 as far as the length of each of the wires 150 changing thereby the relative position of their adjustable wards 58 into the desired combination. Then the sliding bolt is released by sliding out the latch 161 from the mortise 160 of the bolt 99—100.

To change the combination of the lock, the sliding bolt 99—100 is fixed into the unlocking position by the latch 161. Then the key with the same combination as the lock, is inserted into the key-hole as far in as it will go. Then it is turned one twelfth of a turn to either side in order to bring the adjustable wards 58, within the groove 14, to the lines of the longitudinal grooves 8, 9, 10, 11, 12, and 13. Then the key is pulled out. In this position the rod 62 will be protruding through the central bore 70 of the knob 69. The rod 62 is pushed in whereby its head 61 will push the sliding sectors 52 towards the butt-piece 40. The different rows of teeth 53 will pass respectively through the longitudinal grooves 2, 3, 4, 5, 6, and 7, while the adjustable wards 58 are held within the central groove 14; thus when the sliding sectors reach the end 42 of the butt-piece 40—41—42, the combination will be 000000. The key is set to the desired combination and inserted into the key-hole as far as it can go and the wires 150 will cause the sliding sectors 52 to go in the length of the respective wire, 150. Then the key is withdrawn and the sliding bolt 99—100 released by unfastening the latch 161.

If the combination were forgotten and it were wanted to set a new combination; the sliding bolt 99—100 would be brought to the unlocking position by using the knob 69, and fixed in said position by the latch 161. After loosening the screw 74, the outer casing 68 and knob 69 are removed. A stick of proper size is successively inserted into each of the passages 72 and pushed against the respective adjustable wards 58 carrying them as far as the butt-piece 42, whereby the combination of the lock will be 999999. Then the outer casing 68 is replaced and the screw 74 tightened. The key is set to the combination 999999, inserted into the key hole and one twelfth of a turn is given to the turnable body to bring the adjustable wards 58—within the central groove 14—to the lines of the longitudinal grooves 8, 9, 10, 11, 12, and 13. Then the key is withdrawn from the key-hole and the rod 62 is pressed in to slide back the sectors 52 and set the lock to the combination 000000. Now the key is set to the desired new combination and inserted again into the key-hole pushing it as far as it can go causing thereby the sliding of the sectors 52 while their adjustable wards 58 are held in the central groove 14 setting the lock to the desired combination. Then the key is withdrawn and the sliding bolt 99—100 released by unfastening the latch 161.

Of course this construction is available only for locks not accessible by outsiders. For locks which may be easily reached, the collar 71 has no passages 72 and forms a whole with the casing 1, so that it will be necessary to dismount the lock to change its combination when this is unknown.

While this specification sets forth in detail the present construction to be used with door-locks, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

The advantages are readily understood from the foregoing description without need of being specially pointed out.

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

1. In a combination lock, a fixed tubular casing provided at its inner surface with a number of equidistant longitudinal grooves alternating a wide and deep one with a narrow and less deep one; and circular parallel equidistant grooves forming two groups of narrow grooves separated by a wider and deeper groove; substantially as described.

2. In a combination lock, in connection with a fixed tubular casing provided with longitudinal and circular grooves, a turnable body consisting of a skeleton constituted by radial partitions provided with projecting ribs, slidable sectors occupying the angular spaces between the radial partitions, each sector provided with a row of teeth which may pass through the grooves of the aforesaid casing, and each sector also provided with an adjustable ward; substantaially as set forth.

3. In a combination lock, in connection with a fixed tubular casing provided with longitudinal and circular grooves, a turnable body consisting of a skeleton constituted by radial partitions, slidable sectors each sector provided with a row of teeth and an adjustable ward, butt-pieces terminating the turnable body at both ends; substantially as described.

4. In a combination lock, in connection with a fixed tubular casing provided with longitudinal and circular grooves, a turnable body consisting of a skeleton constituted by radial partitions, slidable sectors held in the angular spaces comprised between the radial parti-

tions by suitable ribs projecting therefrom, each slidable sector provided with a row of teeth, and a cross-shaped groove adapted to receive a slidable piece provided with a projecting wide tooth which constitutes an adjustable ward for the lock, and means to hold said slidable pieces in their respective grooves; substantially as described.

5. In a combination lock, in connection with a fixed tubular casing provided with longitudinal and circular grooves at its inner surface, a turnable body consisting of a skeleton constituted by radial partitions provided with projecting ribs, slidable sectors, each sector provided with a row of teeth and a cross-shaped groove adapted to receive a slidable piece provided with a projecting wide tooth which constitutes an adjustable ward for the lock, rods connected to the slidable sectors passing through suitable grooves made in the core of the aforesaid skeleton and through suitable drillings made in the butt-piece of the turnable body, and means within proper mortises in the core of the skeleton to prevent the sectors from sliding out; substantially as described.

6. In a combination lock, in connection with a fixed tubular casing provided with longitudinal and circular grooves, a turnable central body consisting of a skeleton constituted by radial partitions provided with projecting ribs, slidable sectors connected to rods passing through suitable grooves made in the core of the skeleton and through suitable drillings made in the butt-piece of the turnable body, a push-piece which works within the space provided by cutting off a portion of the core of the aforesaid skeleton, said push-piece comprising a star-shaped head and a rod that passes through a suitable drilling made in the other butt-piece of the turnable body, and a coil-spring bearing against the aforesaid star-shaped head and against the bottom of a bore made in the butt-piece, wherein the coil spring is lodged; substantially as set forth.

7. In a combination lock, in connection with a fixed tubular casing provided with longitudinal and circular grooves, a turnable body consisting of a skeleton constituted of radial partitions, provided with projecting ribs, slidable sectors, each sector provided with a row of teeth and with a cross-shaped groove adapted to receive a slidable piece, a slidable piece provided with a projecting tooth constituting an adjustable ward for the lock, butt-pieces which terminate the turnable body, one of them provided with a projecting quadrant adapted to operate the sliding locking bolt; substantially as set forth.

8. In a combination lock a tubular casing provided with longitudinal and circular inner grooves, a turnable body consisting of a skeleton constituted by radial partitions, slidable sectors each one provided with a row of teeth and an adjustable ward, rods attached to said sectors, a butt-piece completing the turnable body and provided with bores to afford passage to the above named rods, said turnable body adapted to be turned by a suitable key having longitudinally adjustable bits; substantially as described.

In testimony whereof I hereunto affix my signature.

SERGIO FAUSTINO de CASTRO é IZNAGA.