A. Z. MAMPLE.

ELECTRIC COMBINATION LOCK.

APPLICATION FILED AUG. 29, 1919.

1,353,257. **Patented Sept. 21, 1920.**

3 SHEETS—SHEET 1.

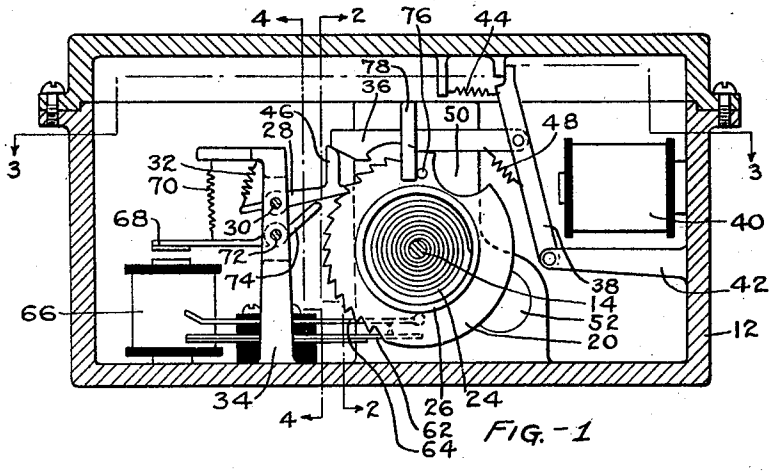


FIG.-1

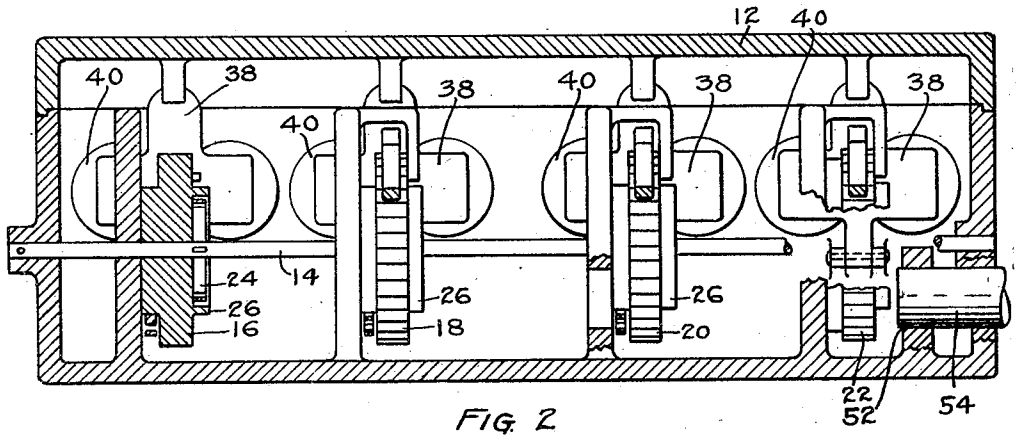


FIG. 2

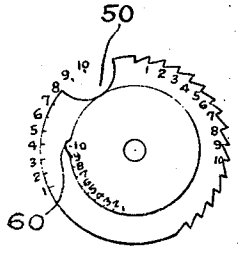


FIG. 5

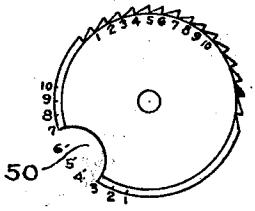


FIG.-6

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3 SHEETS—SHEET 2.

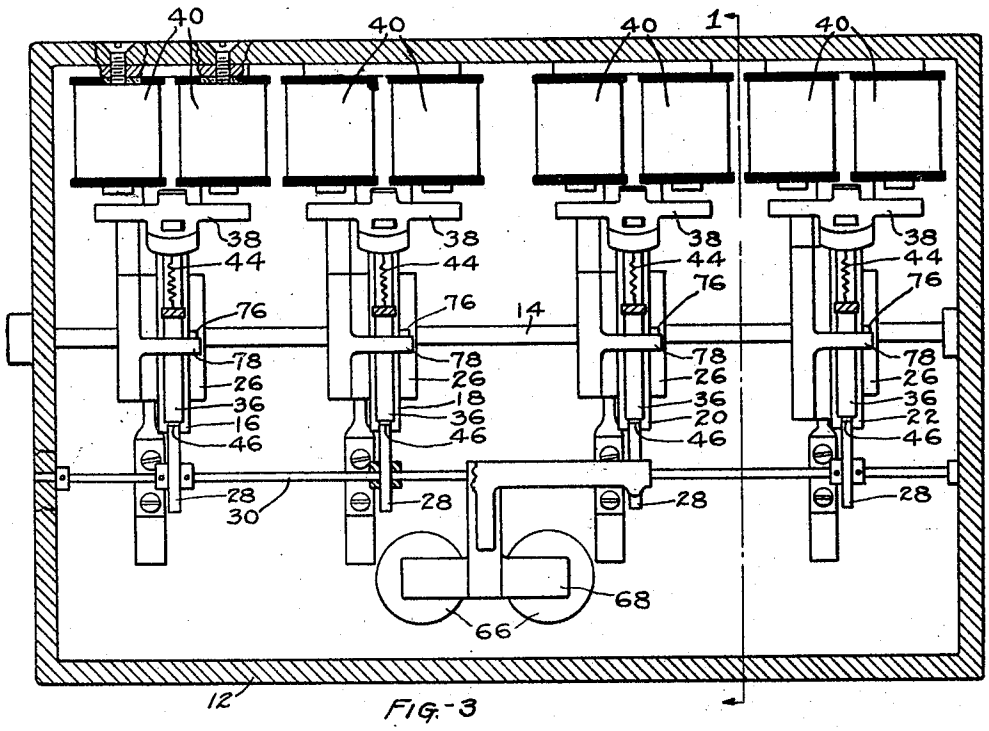


FIG. 3

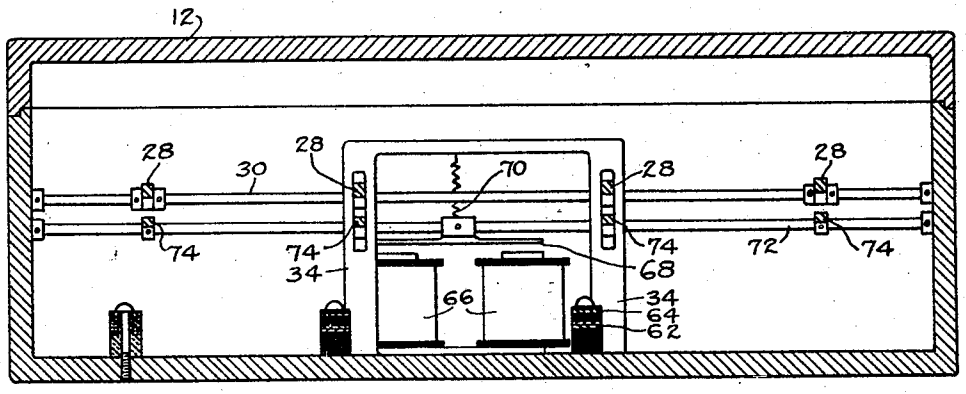


FIG. 4

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ELECTRIC COMBINATION LOCK.

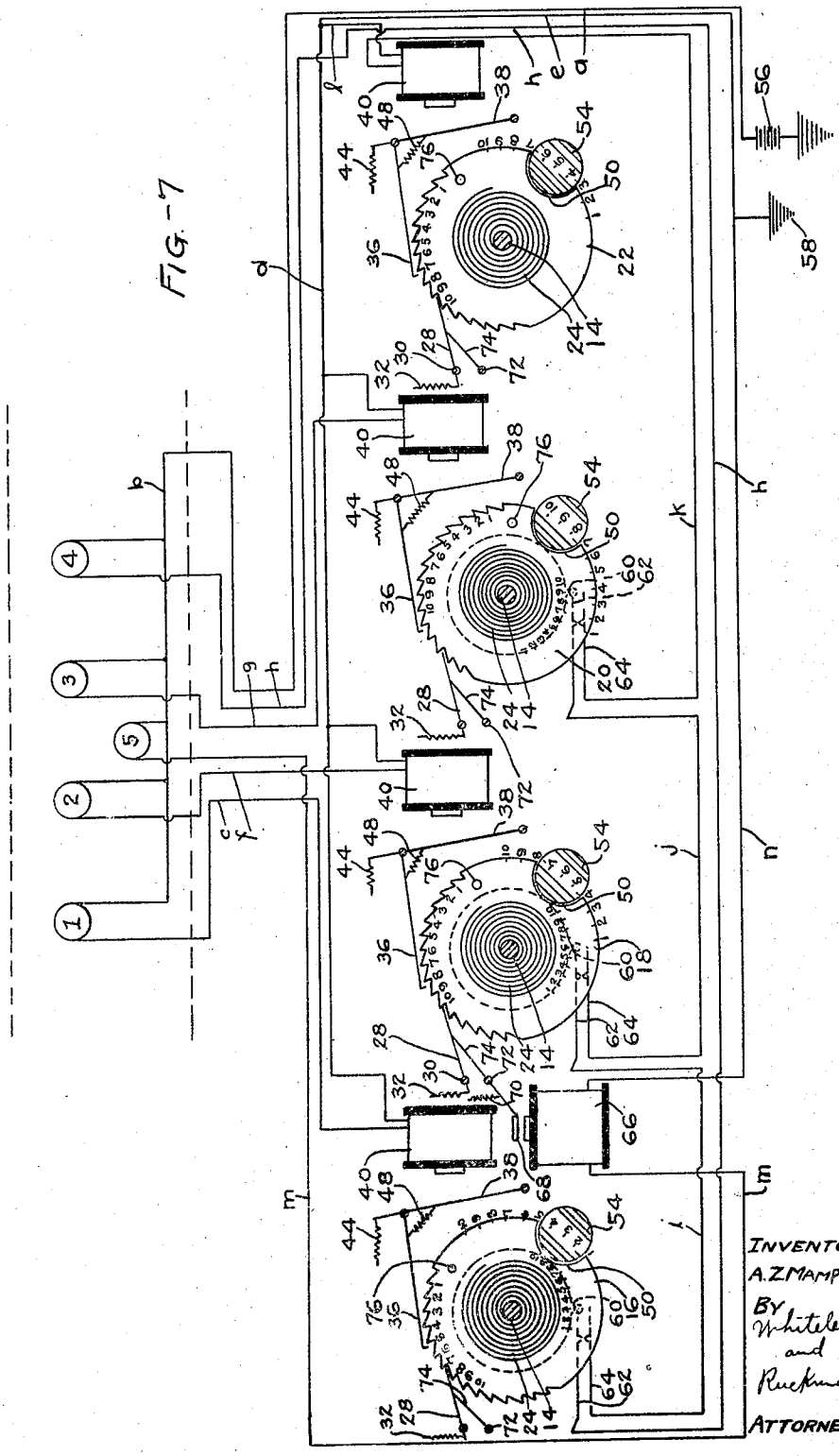
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3 SHEETS—SHEET 3.

FIG. 7



UNITED STATES PATENT OFFICE.

ADOLPH Z. MAMPLE, OF ST. PAUL, MINNESOTA.

ELECTRIC COMBINATION-LOCK.

1,353,257. Specification of Letters Patent. Patented Sept. 21, 1920.

Application filed August 29, 1919. Serial No. 320,616.

To all whom it may concern:

Be it known that I, ADOLPH Z. MAMPLE, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Electric Combination-Locks, of which the following is a specification.

My invention relates to electric combination locks 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. One of the objects of my invention is to provide a lock which may be used to effectively lock automobiles in such manner as to prevent them from being driven, towed or otherwise removed by anyone except the owner or persons authorized by him to use the car.

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 a view in cross-section through the casing on the line 1—1 of Fig. 3, showing one unit in side elevation. Fig. 2 is a view in section on the line 2—2 of Fig. 1. Fig. 3 is a top plan view with the casing in section. Fig. 4 is a view in section on the line 4—4 of Fig. 1. Fig. 5 is a left-hand side view of one of the combination wheels. Fig. 6 is a left-hand side view of another of the combination wheels. Fig. 7 is a wiring diagram of electrical connections.

Referring to the construction shown in the drawings, 12 designates a casing which contains the locking units one of which is shown in detail in Fig. 1. Four of these units may be employed as shown in Figs. 2, 3 and 7, although a greater number may be employed if desired. A fixed shaft 14 extends longitudinally through the casing and loosely mounted upon this shaft are combination wheels 16, 18, 20 and 22. Coiled springs 24 similar to clock springs have their inner ends fastened to the shaft 14 and their outer ends fastened to annular ribs 26 on the sides of the combination wheels. These wheels are provided on a portion of their peripheries with a plurality of ratchet teeth numbered from 1 to 10 and sufficient additional teeth so that the wheels may be held in any of the numbered positions by dogs 28 pivoted on a fixed shaft 30 and normally held in engagement with the teeth by springs 32 secured to the outer ends of the dogs and to the upper ends of standards 34. Pawls 36 are pivoted to armatures 38 of electromagnets 40 attached to the inside of the casing, the armatures being pivoted to brackets 42. When the electromagnets are deënergized, the armatures are held detracted by springs 44 and the pawls are held lifted from contact with the ratchet teeth by extended cam portions 46 on the dogs 28. When the electromagnets are energized the armatures are attracted and the pawls slide off the cam portions 46 and are drawn down by springs 48 so as to engage the ratchet teeth. The positioning of parts is such that when the pawls are thus actuated, the ratchet wheels are advanced a distance of one tooth and this advanced position is normally maintained against the tension of the coiled springs 24 by the dogs 28. The peripheries of the combination wheels are cut out to form notches 50 which are differently positioned on the various combination wheels relatively to the ratchet teeth. When these notches are all brought into alinement with openings 52 in fixed members through which a plunger 54 is adapted to slide, the plunger may be slid through all of the notches, but otherwise it is held in locked position. In the embodiment shown diagrammatically in Fig. 7, the wheels 16, 18, 20 and 22 have the notches positioned to correspond respectively to the ratchet teeth numbered 3, 6, 9 and 5, and this means that in this embodiment the combination number is three six nine five and that the combination wheels in order must be actuated respectively three, six, nine and five times to unlock the device. In Fig. 5, which shows the reverse side of a combination wheel, the notch 50 is shown positioned to correspond to the ratchet tooth numbered 10, which of course might also be designated as 0. It is obvious that the notches may be positioned so as to make up any combination of numbers, and in practice different locks will be provided with different combinations.

The manner of operating the combina-

tion wheels will now be described with reference particularly to Fig. 7, in which an instrument board provided with five push buttons is shown. The buttons numbered 1, 2, 3 and 4 are for operating the wheels 16, 18, 20 and 22, respectively, while the button numbered 5 is for releasing all of the wheels in order to place them in locking position. A suitable source of electrical energy such as a battery 56 is provided. When the button 1 is pushed the current flows through the wire *a*, the wire *b* and the wire *c* to energize the electric magnet 40 associated with the wheel 16, and the current returns through the wire *d* and the wire *e* to the ground 58. Upon pushing the button 1 three times, the wheel 16 is brought to the position shown and is retained in this position by the dog 28 while a lug 60 properly positioned on the reverse side of the wheel depresses a finger 62 and brings a contact point thereon into engagement with a contact point on a finger 64. When the button 2 is pushed the current flows through the wire *a*, the wire *b* and the wire *f* to energize the electromagnet 40 associated with the wheel 18, and the current returns through the wire *d* and the wire *e* to the ground. Upon pushing the button 2 six times the wheel 18 is brought to the position shown and retained by the dog 28, while a lug 60 properly positioned on this wheel closes the contact fingers 62 and 64 associated with this wheel. When the button 3 is pushed, the current flows through the wire *a*, the wire *b* and the wire *g* to energize the electromagnet 40 associated with the wheel 20, and returns through the wire *d* and wire *e* to the ground. Upon pushing the button 3 nine times the wheel 20 is brought to the position shown and is retained by the dog 28, while a lug 60 properly positioned on the wheel closes the contact fingers 62 and 64 associated with this wheel. When the button 4 is pushed the current flows through the wire *a*, the wire *b*, the wire *h*, the wire *i*, the wire *j*, and the wire *k* to energize the electromagnet 40 associated with the wheel 22, and the current returns through the wire *l* and the wire *e* to the ground. Upon pushing the button 4 five times the wheel 22 is brought to the position shown and is retained by the dog 28. On account of the circuit for operating the wheel 22 being through the contact fingers 62 and 64 associated with the wheels 16, 18 and 20, it is apparent that it is necessary to first properly set these wheels before the wheel 22 can be operated. This prevents any person not familiar with the particular combination from starting with the wheel 22, which is nearest the end of the plunger, and feeling out the combination in order to unlock the device. It is obvious that the wheel 22 being the last one in the series does not need a lug 60 and is not associated with fingers 62 and 64.

When all of the combination wheels have been set in the manner described, the plunger 54 may be readily slid through all of the notches 50 to unlock the device. When it is desired to lock the device again the plunger is slid in reverse direction out of the notches 50 and the combination wheels are released and returned to their initial position upon pushing the button 5. In the construction illustrated, the plunger is locked out of the casing 12 but it is evident that if the plunger were provided with circumferential grooves for reception of the combination wheels, the plunger could then be locked in inward position within the casing without changing the principle of operation of the device. Referring again to Fig. 7, it will be seen that the circuit through this button is through the wire *a*, the wire *b* and the wire *m* to an electromagnet 66, the return being through the wire *n* to the ground. When the electromagnet 66 is energized it attracts the armature 68, which is normally held retracted by a spring 70 which is attached at one end to the crossbar of the standards 34. The armature 68 is secured to a shaft 72 rotatably mounted in the casing and in the standards 34. Also secured to the shaft 72 are four trip fingers 74 positioned beneath the dogs 28 so that when the electromagnet 66 is energized, the trip fingers lift the dogs and the combination wheels 16, 18, 20 and 22 are free to return to their initial positions and they are thus returned by the action of the coiled springs 14 which were tensioned during the setting of the wheels. In order to obtain the correct initial position of the wheels they are provided with pins 76 which engage stop arms 78.

The operation of my lock has been fully set forth in connection with the detailed description thereof and the advantages will be readily understood. When applied, for instance, to the driving connections of an automobile it will effectively lock the automobile so as to prevent it from being operated or towed by persons who do not know the combination. The locking units are contained in a strong casing so that it is impossible to get at and operate them in an unauthorized manner without the expenditure of a great deal of time and labor.

I claim:

1. An electric combination lock comprising a series of locking units, electric circuits connected with said locking units, and means for placing each of said locking units in unlocking position by a predetermined number of electric impulses which may be varied in number for each of said locking units.

2. An electric combination lock compris-

ing a series of locking units, electric circuits connected with said locking units, means for placing each of said locking units in unlocking position by a predetermined number of electric impulses which may be varied in number for each of said locking units, and means for preventing unlocking of the last one of said units until the rest of the units have been unlocked.

3. An electric combination lock comprising a series of locking units, electric circuits connected with said locking units, electrically operated means for simultaneously placing said units in locking position, and means for placing each of said locking units in unlocking position by a predetermined number of electric impulses which may be varied in number for each of said locking units.

4. An electrical combination lock comprising a series of combination wheels provided with notches, means tending to hold said wheels in initial position with the notches out of alinement with each other, and means for placing said wheels in succession in unlocking position with the notches alined, by predetermined electric impulses.

5. An electric combination lock comprising a series of combination wheels provided with notches, springs tending to hold said wheels in initial position with the notches out of alinement with each other, means for placing said wheels in succession in unlocking position with the notches alined, by predetermined electric impulses, means for holding said wheels in unlocking position, and electrically operated means for releasing said holding means.

6. An electric combination lock comprising a series of combination wheels provided with differently positioned notches, springs tending to hold said wheels in initial position with the notches out of alinement with each other, said wheels being provided with a plurality of ratchet teeth, pawls adapted to engage said teeth and turn said wheels the distance of one tooth at a time, electrically operated means adapted to move each of said pawls a predetermined variable number of times to bring the notches of said wheels in alinement, dogs for holding said wheels in the positions to which they are turned, and electrically operated means for releasing said dogs.

7. An electrical combination lock comprising a series of combination wheels provided with differently positioned notches, springs tending to hold said wheels in initial position with the notches out of alinement with each other, said wheels being provided with a plurality of ratchet teeth, pawls adapted to engage said teeth and turn said wheels the distance of one tooth at a time, electromagnets for actuating said pawls, push buttons included in electrical circuits for energizing said electromagnets the proper number of times to bring the notches of said wheels into alinement, dogs for holding said wheels in the positions to which they are turned, trip fingers adapted to release said dogs, an electromagnet for releasing said dogs, a push button included in an electrical circuit for energizing said electromagnet to actuate said dogs simultaneously, contact fingers associated with all except the last of said combination wheels and means for bringing said contact fingers into engagement when the associated wheels are moved to unlocking position, said fingers being included in the circuit for operating said last combination wheel whereby the latter cannot be operated until after the other combination wheels have been operated.

8. An electric combination lock comprising a fixed shaft, a series of combination wheels loosely mounted on said shaft and provided with differently positioned notches, coiled springs secured at their inner ends to said shaft and secured at their outer ends to said wheels, stops acting in connection with said springs to determine the initial position of said wheels, said wheels being provided with a plurality of ratchet teeth, pawls adapted to engage said teeth and turn said wheels the distance of one tooth at a time, electromagnets, to the armatures of which said pawls are pivotally attached, push buttons included in electrical circuits for energizing said electromagnets the proper number of times to bring the notches of said wheels into alinement, dogs for holding said wheels in the positions to which they are turned, trip fingers adapted to release said dogs, an electromagnet for releasing said dogs, a push button included in an electrical circuit for energizing said electromagnet to actuate said dogs simultaneously, contact fingers associated with all except the last of said combination wheels, and means for bringing said contact fingers into engagement when the associated wheels are moved to unlocking position, said fingers being included in the circuit for operating said last combination wheel whereby the latter cannot be operated until after the other combination wheels have been operated.

In testimony whereof I hereunto affix my signature.

ADOLPH Z. MAMPLE.