

Oct. 5, 1965

K. LANGREHR
COMBINATION LOCK
Filed July 30, 1962

3,209,567

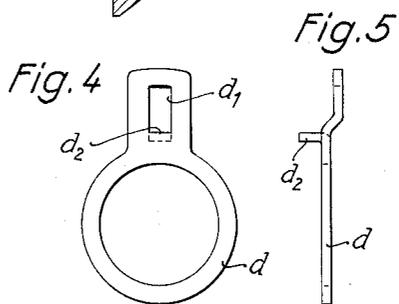
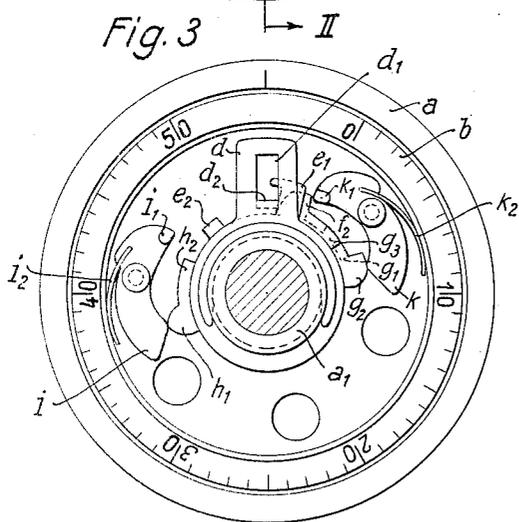
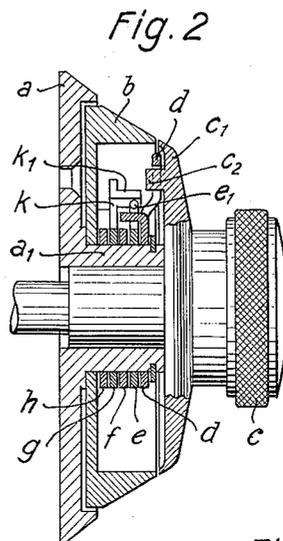
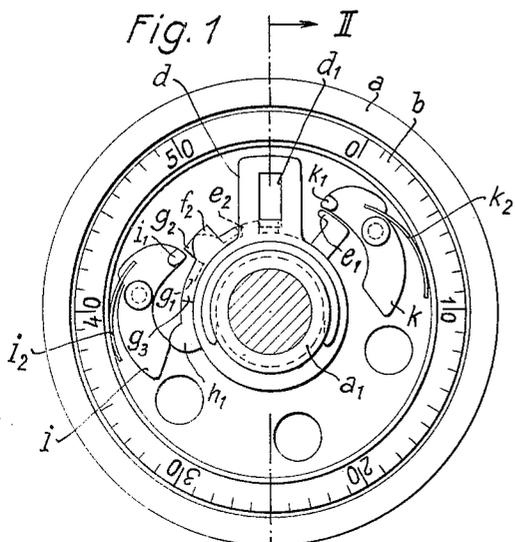


Fig. 5

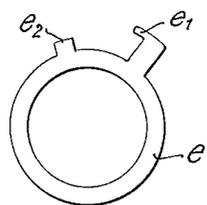
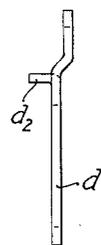
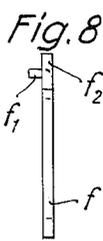
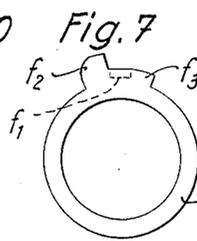
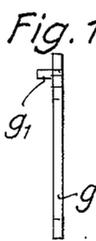
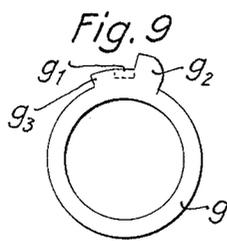
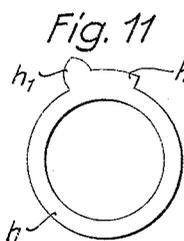


Fig. 6



*I am entor
Karl Langrehr
by: Michael S. Striker
Attorney*

1

3,209,567

COMBINATION LOCK

Karl Langrehr, Hannover-Herrenhausen, Germany, assignor to Otto Sellin, Freiburg, Breisgau, Germany
 Filed July 30, 1962, Ser. No. 213,376
 Claims priority, application Germany, Aug. 8, 1961, B 63,574
 14 Claims. (Cl. 70—320)

This invention relates to a combination lock with a code number setting knob adapted to unlock the lock by alternate rotation of the knob in opposite directions and by thereby consecutively setting a rotatable graduated disc to predetermined numbers. In known combination locks the graduated disc and the setting knob form an integral member. Left or right hand rotation of the knob turns the numbers on the graduated disc past an index mark. Special attention must be paid to the number of times the predetermined number must be rotated into register with the index mark. This is not always easy to do.

Miscounts of the numbers of revolutions of the setting knob and/or failure to ensure that the index mark and the predetermined number properly register are nearly always to blame for failure of the lock to open as expected. If these requirements are again not carefully observed when the operation is repeated the lock will still refuse to open.

It is the object of the present invention to eliminate this difficulty.

This object is attained according to the invention by providing a combination lock with a code number setting knob adapted to unlock the lock by alternate rotation of the knob in opposite directions and by thus consecutively setting a rotatable graduated disc to predetermined numbers, which combination lock comprises means for operatively coupling the setting knob with the graduated disc when the knob has been rotated in the prescribed direction the prescribed number of times. These coupling means may take various forms.

In a preferred embodiment of the invention the coupling means are embodied in coupling pawls and entraining discs or rings which sequentially entrain each other when the setting knob continues to be turned, until one of said entraining rings operatively engages the coupling pawls connected with the graduated disc when the setting knob has been rotated the prescribed number of times.

Conveniently the entraining rings as well as the graduated disc are rotatably mounted on the hub of the baseplate of the setting knob, the setting knob itself being preferably rotatably mounted in the hub of the baseplate of the setting knob.

The invention greatly facilitates setting and resetting the combination lock without in any way reducing its safety and efficiency. The graduated disc of the combination lock is not itself rotated in the direction of rotation of the setting knob until the latter has been rotated the required number of times for opening the lock. Rotation of the setting knob together with the graduated disc is then continued until the first number of the code registers with the index mark.

When this has been effected the setting knob is rotated in the contrary direction until the graduated disc is entrained again. When the second number of the code appears to be in register further rotation is stopped.

The knob is then again rotated in the first direction and the graduated disc set to the third number of the code. Rotation in the opposite direction will then open the lock. This procedure naturally applies to a lock which operates by the selection of three numbers. If only two

2

numbers are required the setting knob need merely be rotated once in one and once in the opposite direction.

A preferred embodiment of the invention will now be described by way of example and with reference to the accompanying schematic drawing, in which:

FIG. 1 is a top plan view of the setting knob, entraining rings and coupling pawls, shown at the instant of entrainment of the graduated disc in one direction, the cover plate having been removed to reveal the mechanism;

FIG. 2 is a vertical section taken on the line II—II of FIG. 1 including the cover plate;

FIG. 3 is a top plan view of the setting knob, entraining rings and coupling pawls shown at the instant of entrainment of the graduated disc in the contrary direction, the cover plate having been removed to reveal the mechanism, and

FIGS. 4 to 11 are plan and corresponding side views of the individual entraining rings.

FIGS. 1 and 2 show a rotatable graduated disc *b* and a circular base plate *a* with a central hub *a*₁.

Rotatably located in the hub *a*₁ is a selector or setting knob *c*. This knob *c* has a radially extending portion *c*₁ which may form, as shown in the drawing, part of a cover with a lug *c*₂ which engages in a slot *d*₁ in an entraining ring *d* rotatably mounted on the hub *a*₁.

Therefore, when the knob *c* is turned to the left, the entraining ring *d* will be forced to participate in this rotation by the engagement of the lug *c*₂ with the slot *d*₁. At the same time a lug *d*₂ (FIGS. 4 and 5) on the entraining ring *d* is carried against a tooth *e*₂ (FIG. 6) on a second entraining ring *e* and carries this ring around with it.

At the end of a full revolution the lug *d*₂ strikes and entrains a tooth *f*₃ (FIGS. 7 and 8) on a further ring *f*.

At the end of another full revolution a lug *f*₁ on the ring *f* strikes a tooth *g*₂ (FIG. 9) on another ring *g* which is now likewise entrained.

At the end of yet another full revolution of the knob *c* a lug *g*₁ on the ring *g* strikes a tooth *h*₂ (FIG. 11) of a ring *h* which is thus likewise entrained. A tooth *h*₁ on the ring *h* now raises a coupling pawl *i* pivotally mounted on disc *b* (FIGS. 1 and 3) and forces a tooth *i*₁ thereon into engagement with the tooth *g*₂ of the ring *g* (FIG. 1).

Operative connection is thus established between the setting knob *c* and the graduated disc *b* which therefore now participates in the further rotation of the knob *c*. In the described case the knob *c* has been turned through three complete revolutions so that the lock can be correctly set by stopping the graduated disc *b* at the first appropriate number.

The setting knob *c* is now turned in the opposite direction. The extending portion *c*₁ and the lug *c*₂ again entrain the ring *d*. The lug *d*₂ on this latter ring now strikes a tooth *e*₁ (FIG. 6) on the ring *e* and a tooth *f*₂ (FIG. 7) on the ring *f*, entraining both rings.

As rotation of the setting knob *c* is continued, the lug *f*₁ on the ring *f* strikes a tooth *g*₃ on the ring *g* and, finally, the tooth *g*₂ on the ring *g* tilts a coupling pawl *k* pivotally mounted on disc *b* so that the tooth *f*₂ is engaged by a tooth *k*₁ of the coupling pawl *k* (FIG. 3). This again establishes operative connection in the opposite direction between the setting knob *c* and the graduated disc *b*. Further rotation of the setting knob *c* therefore entrains the graduated disc *b*. When the second number of the code has been reached, rotation of the knob *c* is stopped. To this end the knob *c* has been rotated through one revolution less than during the previous rotation to the left.

For setting the third number, the knob *c* is again rotated in the opposite direction, i.e. to the left. The knob *c* again carries the two rings *d* and *e* with it to the left by means of its extending portion *c*₁ and the lug *c*₂. The hook-

shaped tooth e_1 now strikes the tooth k_1 of the coupling pawl k and causes operative connection to be established between the knob c and the graduated disc b , this disc b now being entrained after only one revolution of the knob c . The required number of the disc b is now turned into register with the index mark. A further rotation of the knob c to the right to its stop will now open the combination lock.

The coupling pawls i and k are acted upon by pressure springs i_2 and k_2 .

For resetting to the numbers of a different code the appropriate numbers are selected in similar sequence, the setting process being stopped at the last number. A resetting key is then introduced into the combination lock. Finally the new digits are set by turning the setting knob alternately left, right, left and then locking them with the resetting key.

The number of reversals of the knob need not be counted. They necessarily arise when setting the lock for opening the same and when resetting to different code numbers.

I claim:

1. In a combination lock with a code number setting knob adapted to unlock the lock by rotation of the knob a preselected number of full revolutions and then through a predetermined angle in a first direction and by then rotating the knob a preselected number of full revolutions and through a predetermined angle in a direction opposite to said first direction, in combination, a support turnably supporting said setting knob and having a setting mark; a disc having graduations cooperating with said setting mark; and means for operatively coupling the graduated disc with the knob when the knob has been turned in one of said directions the respective preselected number of full revolutions for setting the additional preselected angle the knob has to be turned in said one direction by aligning a predetermined graduation of the disc with said setting mark.

2. A lock according to claim 1, wherein said coupling means are coupling pawls connected with the graduated disc and entraining rings, said entraining rings being arranged to entrain each other sequentially when the setting knob continues to be turned until one of said entraining rings operatively engages the coupling pawls connected with the graduated disc when the setting knob has been rotated the prescribed number of times.

3. A lock according to claim 2, wherein said support includes a base plate having a hub and wherein the entraining rings and the graduated disc are rotatably mounted on the hub of the baseplate.

4. A lock according to claim 3, wherein the setting knob is mounted for rotation in the hub of the baseplate.

5. A lock according to claim 4, wherein the setting knob is formed with radially extending portion provided with a lug which engages in a slot in one of the entraining rings.

6. A lock according to claim 5, wherein said one entraining ring is formed with a lug adapted to make one-way contact with a tooth on a second and on a third entraining ring when the knob is being turned in the appropriate direction.

7. A lock according to claim 6, wherein the third entraining ring likewise has a lug which makes entraining contact with a tooth on a fourth entraining ring when the knob continues to be turned in the same direction.

8. A lock according to claim 7, wherein the fourth entraining ring likewise has a lug which makes entraining contact with a fifth ring when the knob continues to be turned in the same direction.

9. A lock according to claim 8, wherein said fifth ring is provided with a tooth engaging one coupling pawl to move the latter in a direction so that a tooth on the fourth entraining ring makes entraining contact with a tooth of a coupling pawl, when the knob continues to be turned in the same direction.

10. A lock according to claim 5, wherein said lug on said one entraining ring makes entraining one-way contact with a hook-shaped tooth on the second entraining ring and with a second tooth on the third entraining ring when the setting knob is turned in the contrary direction.

11. A lock according to claim 10, wherein the lug on the third entraining ring makes entraining contact with a second tooth on the fourth entraining ring when the setting knob continues to be turned in the contrary direction.

12. A lock according to claim 10, wherein the second tooth on the third entraining ring is moved into entraining contact with a tooth on one of the coupling pawls.

13. A lock according to claim 10, wherein the hook-shaped tooth of the second entraining ring makes entraining contact with a tooth on one of the coupling pawls when the knob is rotated in the first direction.

14. A lock according to claim 2, wherein the coupling pawls are loaded by springs.

No references cited.

ALBERT H. KAMPE, *Primary Examiner.*