Oct. 29, 1940. S. FUTRAN 2,219,866

LOCKING SYSTEM

Filed Nov. 25, 1938

Fig. 1

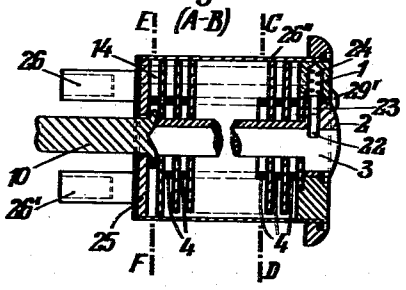


Fig. 2

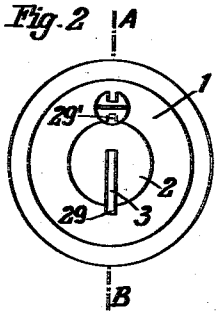


Fig. 3

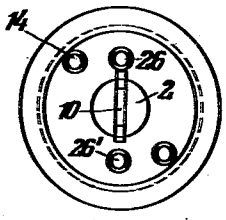


Fig. 4 (C-D)

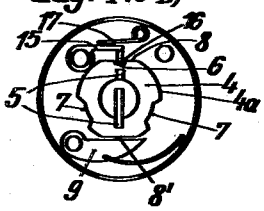


Fig. 5 (E-F)

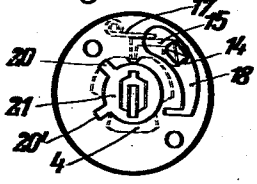


Fig. 6

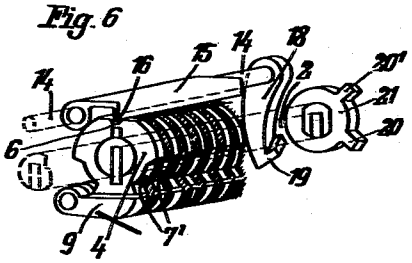


Fig. 7

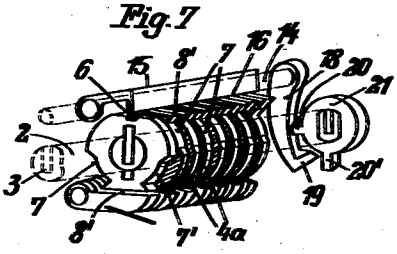
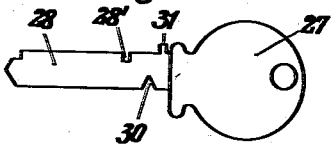


Fig. 8



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LOCKING SYSTEM

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4 Claims. (Cl. 70—383)

This invention relates to locks with a locking mechanism which can be set in the locked position by means of a suitable key, a series of keys or a suitable setting of a separate key provided with variable wards, and can only be opened by the same key or the same setting of the wards and wherein rotary locking discs are used, each of which is provided with two release positions, arranged one behind the other in the direction of rotation, the release positions of the actuated locking discs being temporarily brought in alignment with the release position of the locking discs which have not been actuated for the purpose of releasing the locking action of the locking discs of the first order co-operating with the locking discs and being then, by the further closing or opening movement in the same direction, again moved out of alignment.

The locking bolt of these known locks must not be turned through a complete revolution as otherwise there would be reached the starting position of the locking system and the selected locking combination would be again destroyed. These known locking systems can therefore be only used in connection with a lock which is constructed to fit the same, and which in addition may never be moved than somewhat less than a complete revolution.

The object of the present invention is to so construct these locking systems that they form a self-contained unit (locking cylinder) for co-operating with any lock which is capable of co-operating with a cylinder whether a mortise or rim lock, and to co-operate therewith independently of the number of turns.

An example of construction in accordance with the invention is shown in the accompanying drawing, wherein:

Fig. 1 is a longitudinal section on the line A—B of Fig. 2 of a lock cylinder according to the invention.

Fig. 2 is a front elevation of the lock cylinder.

Fig. 3 is a rear elevation of the lock cylinder.

Fig. 4 is a section on the line C—D of Fig. 1.

Fig. 5 is a section on the line E—F of Fig. 1.

Fig. 6 shows the cylinder in the starting position in which all the locking discs are in the same position.

Fig. 7 shows the cylinder with the locking discs set to a locking combination, and

Fig. 8 shows a key for the locking cylinder.

In the example of construction shown in the drawing, the locking cylinder is provided with a front plate 1 in which there is mounted a rotary cylinder 2 provided with a longitudinal slot 3 for the introduction of a key. On the cylinder 2 are fitted a number of rotatable locking discs 4. Each locking disc is provided with three peripheral recesses 6, 7, 7', serving as unlocking points, which can be divided into two groups, namely the group 6 and the group 7, 7', of which the purpose will be described hereinafter and which are provided at the periphery of the discs. The locking discs 4 are also provided at their periphery with flats 8, 8' against which bear spring actuated locking pawls 9. To the cylinder there is secured axially a driving member 10, which, when the cylinder is turned, actuates in the known manner the bolt connected thereto. On a shaft 14 extending parallel to the cylinder, is pivotally secured an oscillatable feeler 15 of which the end 16, adapted to engage with the recesses 6, 7, 7' of the locking discs, extends over the full depth of all the rotary locking discs. The feeler 15 is subjected to the pressure of a spring 17 which normally tends to press it downwardly against the locking discs. To the shaft 14 of the feeler there is also rigidly secured a locking hook 18 of which the projection 19 co-operates with two pins 20, 20' of a disc 21 keyed to the cylinder. In the cylinder casing and in the cylinder are respectively provided pins 22 and 23 which are subjected to the action of a spring 24 which, in the known manner, when inserting the key releases the cylinder 2 for rotation as a result of the passage of the pin 22 in the notch 30 of the key.

The cylinder is closed at its rear end by a plate 25 in which are provided two securing bolts 26 and 26'. The cylinder is also enclosed in a cylindrical casing 26''.

The method of operation of the lock cylinder according to the invention is as follows.

When assembling the cylinder all the rotary locking discs 4 are brought into the same axial position relatively to one another, that is to say in such a manner that both of the recesses 6 and the recesses 7 and 7' are in alignment with one another as is shown in Fig. 6. For setting the lock cylinder to a predetermined lock combination the selected key 27 is fitted into the rotary cylinder 2. The ward of the key projects through the slot 3 of the cylinder into the groove, of the two grooves 5, of the rotary locking discs 4 which is adjacent the ward so that during the turning movement of the key a coupling is produced between the key, cylinder and locking discs and the cylinder and locking discs partake of the rotary movement of the key. The ward 28 of the key 27 is so constructed that its

length corresponds with the total length of all the rotary locking discs. In the key are provided notches corresponding with the thickness of the separate locking discs. In Fig. 8 one of these key notches is shown at 28'. The solid parts of the ward during the rotation thereof turn with them the associated locking discs, while the locking discs which are opposite the notches of the key ward, which are thus not coupled to the cylinder by the key ward, remain in their normal position.

The spring actuated locking pawls 9, which bear against the flats 8 of the locking discs, provide that the locking discs which are not coupled by the key, are held firmly in their normal position. In the example of construction shown in Fig. 7 this is the first disc in the drawing. It is also preferable to separate from one another the separate locking discs by means of partitions which are not shown in the drawing, so as to effectively prevent any liability of the turning, as a result of friction, of the locking discs which have remained in the normal position.

In the position shown in Fig. 6, that is to say in the position before setting the locking combination, the end 16 of the feeler 15 projects into all the recesses 6 of the locking discs 4. The locking hook 18, keyed to the same shaft 14, as the feeler 15, but which is mounted in the opposite direction to the feeler 15, must therefore carry out, on a rotation of the shaft 14, rocking movements which are opposite to those of the feeler 15. Its projection 19 is therefore, when the projection 16 of the feeler 15 engages with the recess 6, in the position shown, correspondingly raised so that the pins 20, 20' of the disc 21 can pass the projection 19 freely.

When turning the cylinder with the selected key and the actuation effected thereby of the locking discs corresponding to the lock combination, the projection 16, provided with an inclined edge on both sides of the sliding feeler 15, is moved out of engagement with the recesses 6 of the discs which have remained stationary and reaches a higher located non-recessed part 4a of the periphery of the locking discs which have been turned. When the feeler 15 rides up on the higher located parts of the locking discs there is effected simultaneously a movement of the projection 19 of the locking hook 18 towards the centre of the locking disc 21 so that the locking projection is now located in the path of the pins 20, 20'. The projection of the locking hook will consequently, on further rotation of the cylinder come into contact with the pin 20 or 20' which is located nearest thereto according to the direction of rotation of the cylinder. This however does not occur as during the rotation the recesses 7 or 7', according to the direction of rotation, of the actuated discs, come into register with the recesses 6 of the discs which have remained stationary so that the feeler projection 16 can engage with all of these recesses and thus the locking hook projection 19 is rocked out of the path of the pins 20, 20'. After a predetermined angular movement, in the example of construction through 180°, the key can be withdrawn from the axial slot. After withdrawal of the key the connection between the cylinder and locking discs is disengaged. The cylinder and locking disc combination now remain in the position into which they have been brought by the key, as the cylinder is held in its position by the pins 22 and 23 and the separate locking discs by the locking pawls 9 bearing against the flat portion 8 thereof. This position corresponds to the lock cylinder position shown in Fig. 7, which is the starting position for the actuation of a lock, having a suitable number of turns and direction of bolt movement, to be connected to the operating member 10 of the cylinder. From this position the lock is actuated when locking or opening (the latter for example in the case of a snap lock) and it is again returned into this position after actuation. From Fig. 7, in which, as already indicated above, there is illustrated a locking combination, in which all the locking discs, with the exception of the disc shown first in the drawing, have been moved by the key and have been turned through half a revolution, it will be seen that the recess 6 of the locking disc which has not been moved, is still, as before, below the projection 16 of the feeler 15. The recesses 6 of the locking discs which have been moved are however no longer in this position. Instead there has been moved into the position thereof a part of the locking discs which is not provided with a recess and thus located at a higher level. As a result the straight line of recesses formed by the recesses 6 of all the discs is no longer present over its entire length and therefore the projection 16 of the feeler 15 is prevented by the said raised portion from engaging with the recess 6 of the disc which has not been moved. This interruption of the direct line of recesses will always occur irrespective of the number and sequence of the locking discs which have been moved or which have not been moved when turning with a selected key combination.

The rocking hook 18, by reason of the fact that the feeler 15 now rests on solid portions of the locking discs, is now located in the path of the pins 20, 20' of the locking disc 21 in consequence of having been rocked in a direction opposite to that of the feeler.

As will further be seen from Fig. 7 the recesses 7 and 7' of the moved locking discs directly flank the recess 6 of the locking disc which has not been moved in the example of construction in both directions of rotation.

The result of this positioning of the separate members of the lock cylinder is that the turning of the cylinder in any direction for actuating the lock is only possible when the locking discs are brought into such a position that the projection 16 of the feeler 15 can engage with the recesses forming an uninterrupted line and thus at the same time the rocking frame 18 is rocked out of the path of the pin 20 or 20'. This is the case when there is selected for actuation a key which corresponds to the said locking combination, that is to say a key which is provided with recesses at the points which correspond with the locking discs which have not been moved.

When using a key of this character the solid parts will actuate the locking discs corresponding thereto, that is to say in the case of the example, all of them with the exception of the first one shown in the drawing. After passing through a comparatively short angular movement, which corresponds to the spacing of the locking hook projection 19 from the pins 20 and 20' of the locking disc 21, thus for example an angular movement of about 20°, which in turn, according to the direction of rotation, corresponds with the distance from the summit of the locking disc to the commencement of the recess 7 or 7', the rotation of the cylinder and of the locking discs can be continued when the locking

hook 18 has been rocked to such an extent out of the path of the pin 20 or 20' that this can pass, that is to say when the above described uninterrupted line of recesses is present. This can only be the case when a key is used which moves those disc combinations to which the cylinder has been set.

On further rotation the projection of the feeler 16 again rides over the solid peripheral portions of the locking discs so that the locking hook carries out a movement into the path of the pins 20, 20'. As one of these pins has already passed the projection 19 of the locking hook 18 the further rotation of the cylinder cannot be prevented until it has been carried out to such an extent that the second pin comes into the vicinity of the projection 19 of the locking hook 18. As the rotary movement of the cylinder up to this point was only possible by means of the correct key a locking action is also prevented at this point as the correct key makes provision that a complete line is again formed by the recesses 6 of the locking discs which have not been moved and the recesses 7' or 7 of the discs which have been moved according to the direction of rotation. At this moment the projection 16 of the feeler 15 can descend into the recently formed line of recesses of locking discs and thus the hook 18 is swung out of the path of the second pin and does not obstruct the passage thereof. This operation is repeated during the course of the second rotary movement of the cylinder so that provision is made for an unlimited rotary movement of the cylinder.

If an attempt is made to actuate a lock which is set to a predetermined locking combination (for example that shown in Fig. 7) by means of a key which does not correspond with the locking combination then the following occurs:

After a short rotary movement of the lock cylinder through a slight angle of rotation the pin 20, 20' of the disc 21 meets the projection 19 of the locking hook 18 which prevents further rotation of the disc 21 and thus of the entire system. It must do this because the projection 16 of the feeler 15 cannot carry out a downward movement as there is not formed a complete line of recesses which can only be formed when using the correct locking combination. If for example the first locking disc in Fig. 7 which was not moved, was moved, then none of the three recesses in this disc would lie underneath the projection 16 of the feeler 15 but a solid peripheral part 4a so that the necessary uninterrupted line of recesses would not be available. When on the other hand any one of the discs which was moved when setting the locking combination is not again moved, then its solid peripheral portion, which is not provided with a recess, remains under the feeler projection so that the line of recesses is also interrupted at this point. It will thus be seen that it is only possible to effect a rotation of the cylinder when using a key corresponding exactly with the set locking combination.

By a suitable device, for example an arrangement of notches 28, 29', in the front plate 1 of the cylinder and a corresponding projection 31 on the key, provision is made in the known manner that the key can only be inserted and removed at these two points. For example by providing a screw at the notch 29' provision may again be made in the known manner, that the key can only be inserted and withdrawn at the notch 28 so as to actuate the cylinder when the locking combination has been set. The notch 28 serves for the purpose, after removing the locking screw, to enable in the case of necessity, a change of keys to be made for setting a new locking combination. By the provision of the notch 28 a disturbance of the combination cannot take place when using an incorrect key, as the incorrect key which is inserted and which can only carry out a small rotary movement, cannot be again withdrawn from the cylinder until it has again returned into their normal position all the discs which were moved incorrectly and has again returned to the position of the notch.

When it is desired to set the lock cylinder to another combination, this can only be effected with the assistance of the key corresponding with the previous locking combination as it is only possible with this key to carry out a rotary movement of the cylinder to such an extent that the locking discs are returned into the position shown in Fig. 6. In this position the key is in a position in which the projection 31 is opposite the groove 28 so that after removing the screw it can be withdrawn from the cylinder.

It is now possible to effect a fresh setting of the locking system which is now in the zero position to a new locking combination by inserting another key. This is effected in the same manner as the locking system was moved from the assembly zero position into the first combination locking position. Preferably after this fresh setting has been effected, the notch 29' is closed by the screw so that an accidental withdrawal of the key at this point cannot take place.

It is also possible to effect the locking and release of the cylinder by the co-operation of the feeler and corresponding raised portions instead of by the co-operation of the feeler 16 and the recesses 6, 7, 7'. In this case it will be necessary to modify the relative co-operation between the locking hook 18 and the rotary disc pins 20, 20'. The recesses and raised portions instead of being arranged in a radial direction at the periphery may also be arranged in an axial direction at any other point of the surfaces of the locking discs 4. The principle of the method of operation of the lock cylinder remains the same also in these cases.

I claim:

1. In combination a cylinder having a longitudinal peripheral recess therein, an actuating member connected to said cylinder, front and rear plates in which said cylinder and actuating member are rotatably mounted, a casing connecting together said plates, a plurality of discs rotatably mounted on said cylinder, each of said discs having a narrow recess and two elongated recesses in the periphery thereof, each of said discs having a notch in the inner periphery thereof, a spring actuated pin mounted in said front plate, said cylinder having a hole therein for co-operation with said spring actuated pins, a shaft pivotally mounted in said plates, spring actuated pawls mounted on said shaft, each of said discs being provided with a flat at its periphery, said pawls being adapted to co-operate with said flats, a second shaft mounted in said plates, a feeler keyed to said shaft, a projection on said feeler, said projection in the normal position of said discs on said shafts engaging with the narrow recesses on said discs, said narrow recesses being located diametrically opposite said flats whilst an elongated recess is located on opposite sides of said discs between said

flat, said projection being adapted to engage with any of the recesses of said discs when brought into alignment, a hook keyed to said second shaft, a projection on said hook, a locking member keyed to said cylinder, two projections on said locking member, said projections being adapted to co-operate with said projection on said hook.

2. In a locking system according to claim 1, including a spring co-operating with said feeler, so as to press the same towards said discs, each of said discs having a second internal notch diametrically opposite the first notch and a screw engaging with said front plate and serving to cover said second notch.

3. In a locking system the combination comprising an inner cylinder, a plurality of locking discs mounted on said inner cylinder, said discs being mounted for rotation to an unlimited extent in any direction on said cylinder, each of said discs having a narrow peripheral recess and a pair of elongated peripheral recesses therein, each of said discs being provided with diametrically oppositely located flats, the elongated recesses being located one on each side of one flat while the narrow recess is located in the other flat, said inner cylinder having a longitudinal peripheral recess therein, each of said discs having an inner notch therein, said notches in the normal position being in register with said longitudinal peripheral recess, a plurality of spring actuated pawls, said pawls co-operating one with each disc and being adapted to engage with one of the flats thereon so as to hold said disc in position, a locking disc on said cylinder, a pair of spaced projections on said locking disc, a feeler operatively associated with said discs, and a hook secured to said feeler, said hook being so secured to said feeler that when the recesses in the discs are in alignment and the feeler engages therewith, the hook is out of the path of the projections of the locking disc, whereas when the recesses of the discs are not in alignment the hook lies in the path of the projections of the discs.

4. In a locking system the combination comprising an inner cylinder, a plurality of locking discs mounted on said inner cylinder, said discs being mounted for rotation to an unlimited extent in any direction on said cylinder, each of said discs having a narrow recess therein, each of said discs having a pair of elongated recesses therein, said inner cylinder having a longitudinal peripheral recess therein, each of said discs having an inner notch therein, said notches in the normal position being in register with said peripheral recess, a locking member mounted on said cylinder, projections on said locking member, a feeler member rotatably mounted adjacent said discs, a projection on said feeler member, said projection being adapted to co-operate with the recesses of said discs, a locking hook keyed to said feeler and a projection on said hook, said projection on said hook being adapted, when recesses of the various discs are in alignment and the projection on said feeler engages with said recesses, to lie out of the path of the projections on said locking member, while when the recesses of the discs are not in alignment the projection on the hook lies in the path of the projections on the locking member.

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