Sept. 12, 1944. G. HÖNGER 2,358,164

CYLINDER SAFETY LOCK

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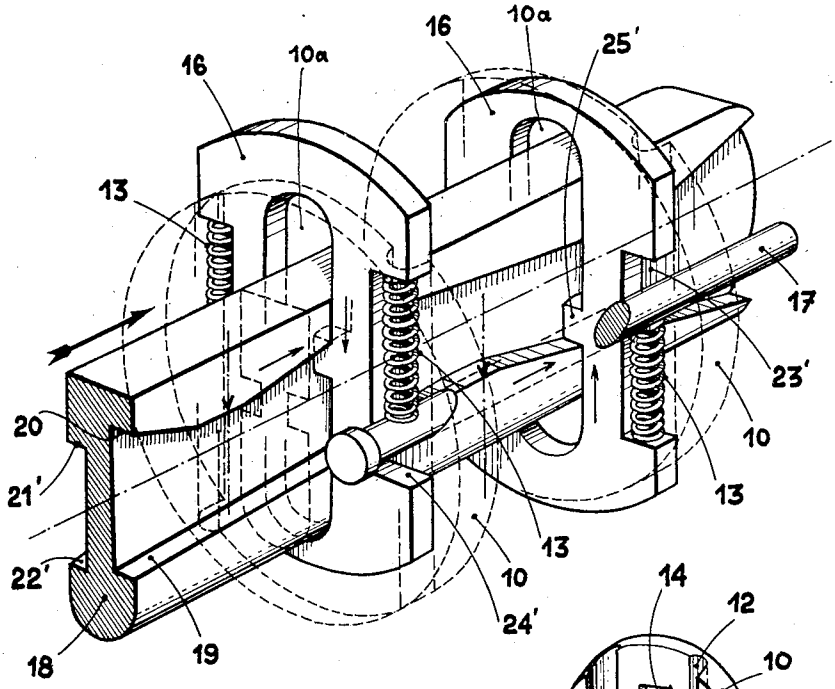


FIG. 1.

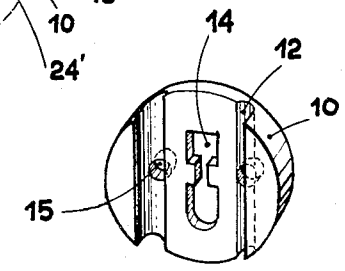


FIG. 3.

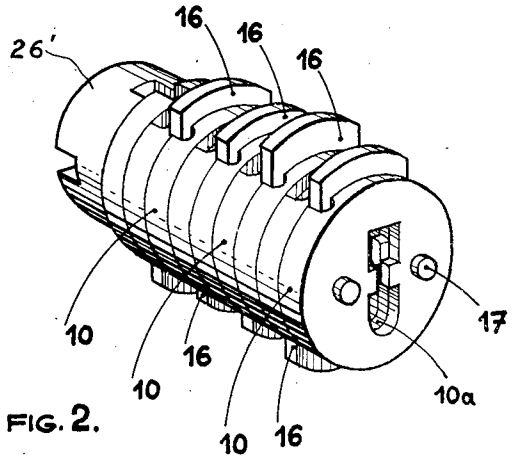


FIG. 2.

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CYLINDER SAFETY LOCK

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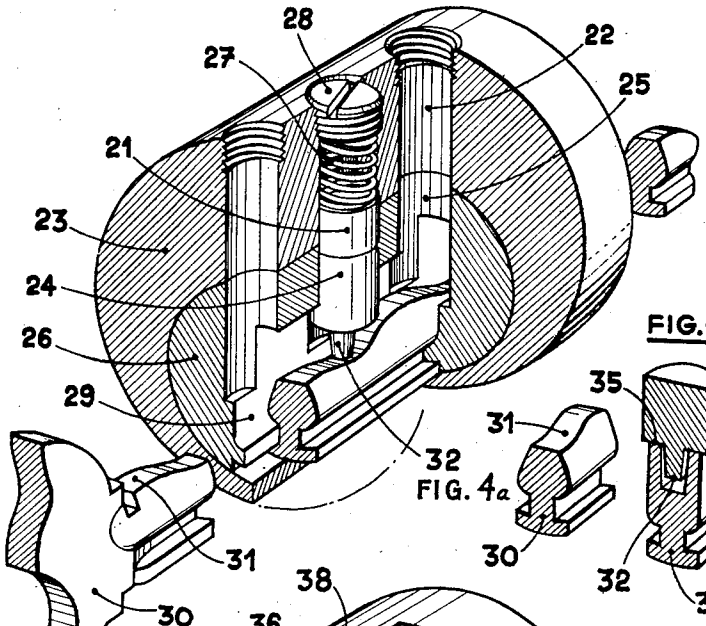


FIG. 4

FIG. 4a

FIG. 4b

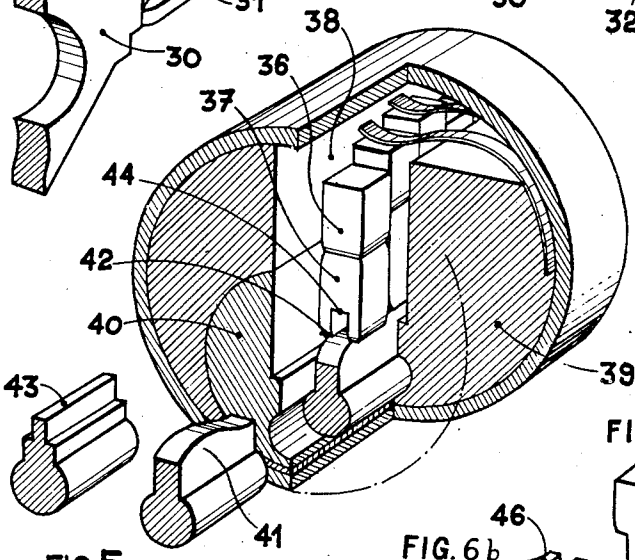


FIG. 5a

FIG. 5

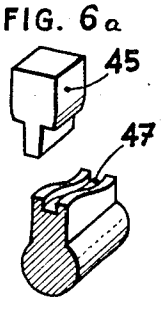


FIG. 6a

FIG. 6b

FIG. 6

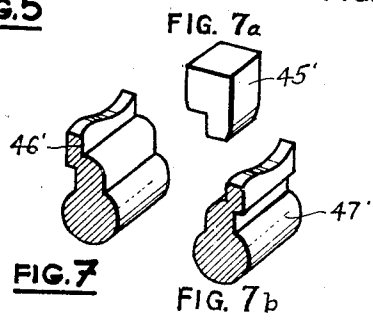


FIG. 7a

FIG. 7

FIG. 7b

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CYLINDER SAFETY LOCK

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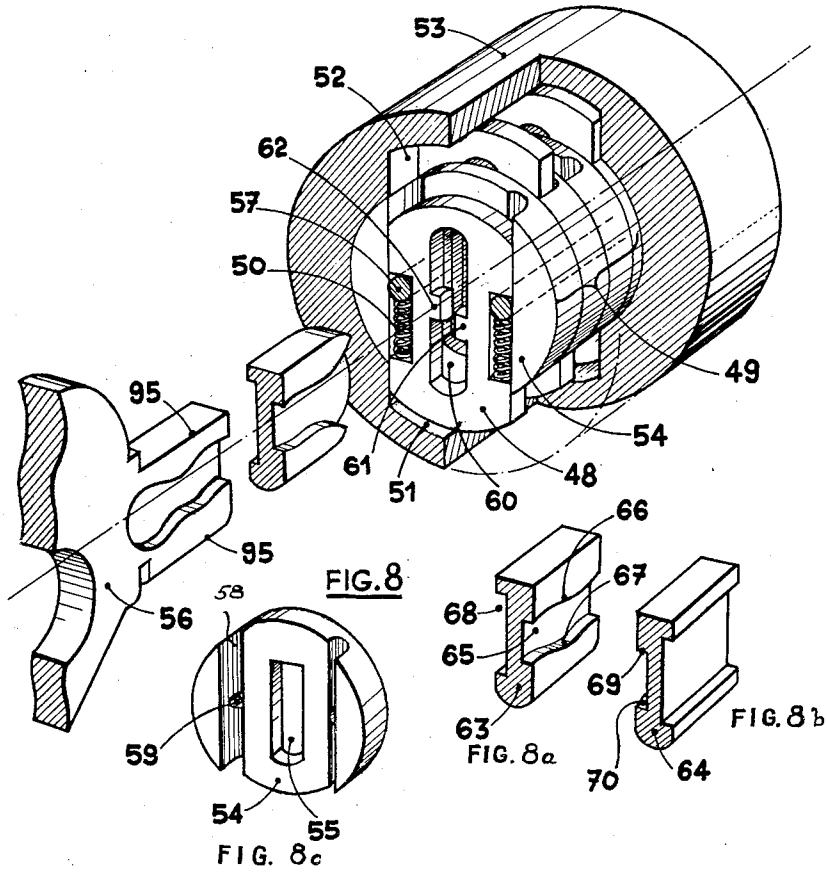


FIG. 8

FIG. 8a

FIG. 8b

FIG. 8c

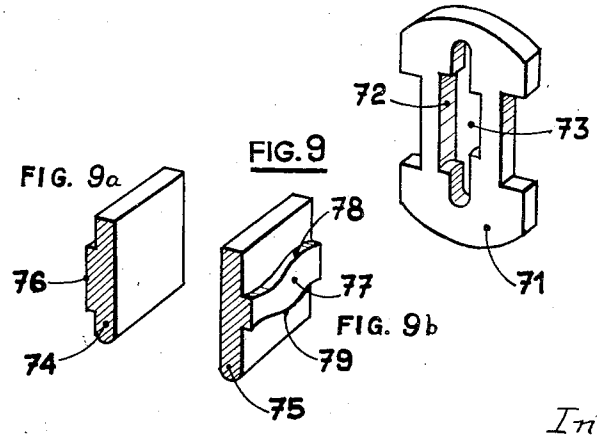


FIG. 9

FIG. 9a

FIG. 9b

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CYLINDER SAFETY LOCK

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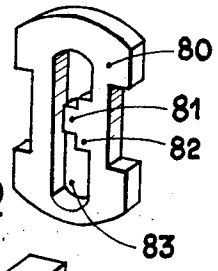


FIG. 10

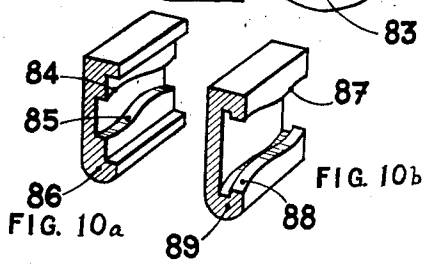


FIG. 10a FIG. 10b

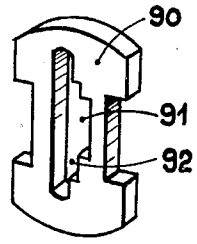


FIG. 11

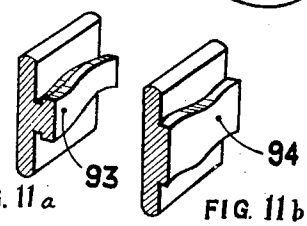


FIG. 11a FIG. 11b

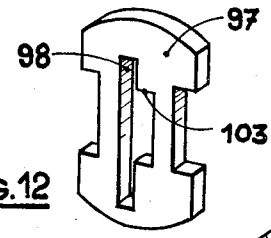


FIG. 12

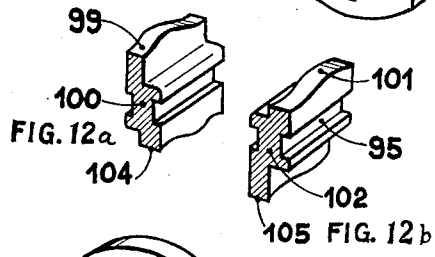
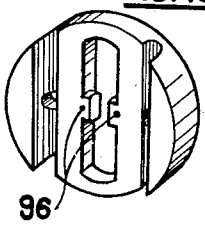


FIG. 12a FIG. 12b

FIG. 15



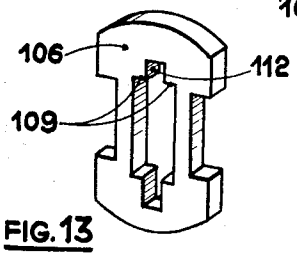


FIG. 13

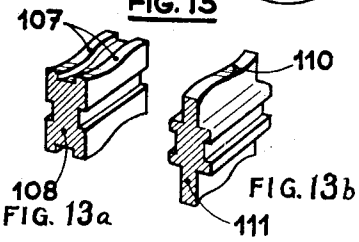
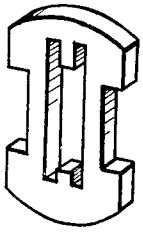


FIG. 13a FIG. 13b

FIG. 14



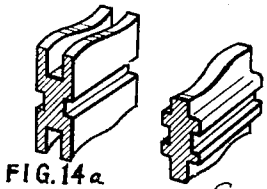


FIG. 14a FIG. 14b

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Patented Sept. 12, 1944 2,358,164

UNITED STATES PATENT OFFICE

2,358,164

CYLINDER SAFETY LOCK

Guido Hönger, Geneva, Switzerland, assignor to Mefina S. A., Binningen, Switzerland, a corporation of Switzerland

Application July 7, 1942, Serial No. 450,025
In Switzerland August 18, 1941

8 Claims. (Cl. 70—364)

The safety locks consist generally of a body in which a controlling cylinder, connected to a locking device, revolves. In safety position the rotation of the cylinder is hindered by a series of elements consisting of rods or small plates sliding at right angle with regard to the cylinder axis and penetrating into corresponding openings in the body and the cylinder. The introduction of the proper key in the cylinder of the lock drives back the locking elements within the body of the lock or drives them internally into the cylinder and unlocks the latter. To this purpose the key is provided with an undulated or stepped ramp or a plurality thereof, the profile of which depends on the shape and dimensions of the various locking elements.

The elements constituting the locking device of the lock and more especially the cylinder and the stop elements are desirably standardized in order to permit their manufacturing by slotting machines or by automatic lathes at a moderate cost, and to reduce to a minimum the patterns necessary for the assembling of a lock.

Actually a very small number of patterns is sufficient for obtaining a considerable number of combinations of locks which are all different the one from the other, thus insuring the maximum of safety. If, for instance, for a group of locks embodying six stop elements, there are four different patterns of these elements, each of which can assume two different positions, it will be possible to obtain 8^6, viz. over 260,000 different locks.

This is however no longer possible when a group of locks has to be operable by means of the so called master-keys. In order to obtain such a device it is usual to adopt any combination for the master-key using all the stop elements available in a lock, whereas in each cylinder of the locks of said group, one or more stop elements are eliminated for the individual key, so that these individual locks are all different with regard to each other, although they all can be operated by the same master-key.

Thus, if up to three stop elements are eliminated for each cylinder, only 41 different combinations of individual locks are possible.

It is clear, therefore, that, unless the number of elements assembled in each cylinder be substantially increased, this device hardly meets requirements of buildings, offices, works or hotels which, generally speaking, raise rather complicated safety problems, such as individual safety locks with a general master-key, a group master-key, etc.

One object of the present invention is to obtain a safety lock embodying locking components subjected to the action of springs and guided diametrically within the cylinder, the body of this latter being constituted by a stack of a certain number of identical guiding elements, their connection being obtained by means of a terminal-piece by which the bolt of the safety lock is operated, the locking elements sliding in diametral slots of the guiding elements.

Another object of the invention is to design safety devices in such a way that they admit the use of general master-keys as well as group master-keys, without, however, limiting the possible combinations of the individual locks.

According to the invention, each of the locking elements of the cylinder controlled by the key of the known locks is provided with one or several individual contact points, distinct for one or several master-keys, independently of one or more of the contact points provided for the individual key. Thus, each of the stop elements forming a lock has two groups of contact points, totally independent from each other, one of which is intended for one or several master-keys, and the other one for the individual key.

The individual key can have a sloping- or step-shaped ramp profile, totally different from the one chosen for the master-key, which not only keeps for the individual keys the maximum number of possible combinations, but permits also arrangements for general or group master-keys meeting all requirements.

Standardization of the locking components for a given type of lock can be obtained by combining some standard positions of the contact points of the master-keys. If an increase of the number of the standard locking elements is required for a group of locks, there is actually a lessening of the number of the necessary elements, due to the fact that the use of the master-keys does not imply any restriction of the possible combinations.

This principle can be adapted to all cylinder safety-locks.

The accompanying drawings illustrate in perspective views examples of various embodiments of the present invention.

Fig. 1 shows part of a key co-operating with two locking elements, as well as the assembling of these latter. For clearness' sake the single components are not shown set closely together, but are intentionally somewhat removed axially.

Fig. 2 shows the assembling of the components constituting a cylinder.

Fig. 3 shows a single component.

Fig. 4 shows a cross section through a safety-lock, provided with locking elements in the form of cylindrical pins which are pushed in the outside direction by the corresponding key. Figs. 4*a* and 4*b* are cross-sectional detail views of the keys.

Fig. 5 is a cross section through a lock based on the same principle equipped, however, with stop elements of rectangular cross section. Fig. 5*a* is a cross-sectional detail view of a key for said lock.

Figs. 6, 6*a*, 6*b* and 7, 7*a*, 7*b* show other shapes for the stop elements and for the profiles of corresponding keys of the lock represented in Fig. 5.

Fig. 8 shows in cross section the cylinder of a lock according to another embodiment. Figs. 8*a*, 8*b*, 8*c* are detail views thereof.

Figs. 9, 9*a*, 9*b*; 10, 10*a*, 10*b*; 11, 11*a*, 11*b*; 12, 12*a*, 12*b*; 13, 13*a*, 13*b*; 14, 14*a*, 14*b*; and 15 show various forms of plates usable in the lock illustrated in Fig. 8 and for the profiles of the corresponding keys.

With reference to the Figs. 1 to 3, the cylinder is constituted by a stack of pieces in form of discs **10**, each of which is provided with a diametral notch **11** in which a locking element **16** is set, and a central opening **14** for the passage of a key, this opening being the same for all elements **10**. In the example shown, the key is kept in position against any transverse displacement which might develop under the action of the locking elements when the key is introduced into the cylinder, by the upper and lower faces of the openings **14**. Each piece **10** is provided with two holes **15** through the bottoms of grooves **12** formed one at each side of the notch **11** (Fig. 3).

Each locking element **16** consists of a slotted plate, provided in its central part with a slot **10***a* for the passage of a key **18**, as shown in Fig. 1. These elements, the largest dimension of which corresponds to the diameter of the cylinder, are provided at both sides with a recess **23'** defined at top and bottom (Fig. 1) by two opposite ledges **24'**.

As shown in Figs. 1 and 2, the assembly of the lock cylinder consists of a stack of parts **10** connected to a terminal piece **26'** by which the bolt of the safety lock is operated, said parts **10** having rotary movement only in the lock.

The elements constituting the cylinder are secured together by two rods **17** traversing the holes **15** of the elements **10**. These rods serve also as abutments for the springs **13** (Fig. 1) which operate on the locking elements **16**. These springs are located between one of the ledges **24'** and the rod **17**, the other ledge **24'** cooperating with the opposite face of the rod **17** as a stop.

The extremities of the elements **16** projecting outside the cylinder, have the same curvature as this latter, so as to lie flush with it, when they are operated by the key **18**. The key acts on a nose **25'** in the central opening **10***a* of each element this nose contacting with one of the operating surfaces **19**, **20**, **21'** or **22'** of the key (Fig. 1).

Whereas the guiding parts **10** are all identical to each other, the locking elements **16** are, generally speaking, different one from another.

It is found sufficient to provide from six to twelve different locking elements. By combining them properly together it is possible to assemble a practically unlimited number of different locks. The difference in the shape of the six to twelve locking elements consists in the position of their lateral recesses **23'** or ledges **24'**, with regard to the internal noses **25'** which co-operate with the contact surfaces of the key.

It is clear that with these parts, very many combinations can be obtained. A locking element of a definite shape can be arranged in different ways within the corresponding guiding element. Thus, as shown on Fig. 1, the nose **25'** of one of the locking elements, can co-operate either with the lower contact surface **19** or with the upper contact surface **20** of the key. The same locking element could also be turned around in the cylinder in such a way that the nose **25'** would co-operate in a similar way with contact surfaces **21'** or **22'** on the opposite side of the key. One can use, of course, only a part of the contact surfaces of the key. On the other hand, the contact surfaces of the key can all be different one from another or be pairs of similar surfaces. This makes it possible also to provide master-keys for the many different combinations. At all events it clearly appears that, in spite of the simplicity of the different components, which are partially similar to each other, it is possible to provide a larger number of lock combinations than by other known means.

The cylinder shown in Figs. 1 and 2 is only an example of a practical embodiment of the invention. It is possible to eliminate the connecting rods **17** by providing on each guiding element, projecting noses on one face engaging corresponding recesses on the other face. Thus, when assembling, the projecting noses and the recesses of adjacent elements would also hinder a relative angular displacement between the assembled parts and would also allow the use of projecting noses as abutments for the springs and as stops.

Instead of the noses **25'** of the locking elements, it would be possible to provide that other parts would co-operate with the key. Thus, for an example, for a key, the contact parts of which are its upper and lower edges, it is possible to provide co-operation therewith of the upper and lower faces of the key-hole.

In the lock of the type shown in Fig. 4, each locking element consists of two cylindrical pins of the same diameter one of which, **21**, slides within a bore **22** in the body **23** of the lock, whereas the other one, **24**, slides within a bore **25** in the cylinder **26**.

In the locked position of the cylinder, the bores **25** lie opposite to the bores **22** and, under the action of the spring **27** which abuts against a screw-cap **28**, which closes the bore **22** at the outside, the external pin **21** pushes the internal pin **24** partially into the cylinder **26** and locks the latter in the body of the lock **23**.

The cylinder **26** is provided, intersecting the bores **25**, with an axial opening **29** corresponding to the full profile of each key.

When introducing into the opening **29** of this lock the corresponding key **30**, a wave-shaped ramp **31** on the key engages a stub **32** on the inner pin **24** which latter pushes the external pin **21** against the spring **27**.

The corresponding key, of cross sectional profile **30** (Fig. 4*a*), is cut with a ramp **31** of such a contour that, when it is fully inserted into the cylinder **26**, it places each of the pins in the unlocking position, that is, all the external pins **21** are pushed into the body **23** without, however, any penetration of the internal pins **24** into the body **23**.

The pins **24** can also be lifted by another key of cross sectional profile **33** (Fig. 4*b*) and having

spaced ramps 34 cooperating with the shoulders 35 around the stubs 32.

In each pin 24 of a same lock, if the distance between the points of stubs 32 and the shoulders 35 be uniform, then, the respective ramps 31 and 34 of both keys 30 and 33 would show an identical shape. However, by a lock with pins having this distance of different magnitudes, the forms of the ramps become quite different for both the keys which can set all pins in the same unlocked position.

Fig. 5 shows a lock operating according to the same principle as that of the lock illustrated by Fig. 4. However, the locking elements 36, 37 are of a rectangular cross section and are arranged side by side to slide in a longitudinal slot 38, milled in the body of the lock 39, and cylinder 40. The profile of the key 41 is designed to cooperate with ramp edges 42 on the locking element 37 whereas the key with profile 43 (Fig. 5a) operates on the face 44 formed by the bottom of the recess between the ramps 42.

In the same arrangement of the lock, it is possible to use the pins 45 of the cross sectional profile according to Figure 6 with keys of corresponding profile 46 and 47 shown in Figs. 6a and 6b.

Figs. 7, 7a, 7b show another of the numerous possible shapes of the pins 45' and key profiles 46', 47' which can be used in a lock of the construction illustrated by Fig. 5.

The same principle could be applied to the manufacturing of pin locks of either a circular or a rectangular cross section. The contact point of these pins for the different keys may be constituted either by stubs, or by lateral slots.

The safety lock according to Fig. 8, works in a different way. Each locking element is formed by a plate 48 the height of which is equal to the diameter of the cylinder 49. These plates slide internally in this cylinder and lock it, under the action of two springs 50, by penetrating into one of the recess 51 and recess 52 provided in the body 53 of the lock.

The cylinder 49 is formed of a stack of a desired number of plates 54 provided at their centre with a slot 55, for guiding the key 56 and held together by two rods 57 which serve also as abutments for the springs 50. In Fig. 8c one of the plates 54 is shown separately showing clearly the opening 55 for guiding the key 56, grooves 58 for the location of the springs 50, and holes 59 for the connecting rods 57.

The arrangement is such that the plates 48 can lock the cylinder 49 by penetrating into either the lower recess 51 of the body of the lock, if, according to Fig. 8, the springs 50 are placed underneath the assembling rods 57, or into the upper recess 52 in case the springs 50 are arranged to act in the opposite position.

In the same cylinder it is possible to alternate the position of the springs of the several plates, in such a way, that, in the locked position, one half of the number of the plates penetrates into the lower recess 51 of the body of the cylinder 53 whereas the other half penetrates into the opposite recess 52. By this arrangement the inclination of the ramps for the points of contact of the corresponding keys, is lessened.

The unlocking of the lock is obtained by introducing into the cylinder a key, which, by means of convenient ramps, thrusts on the locking elements at given contact points and operating against the spring action, entirely withdraws the plates inside the cylinder.

The profile of the key and of its ramps depends on the shape of the plates and of the position of the contact points.

In Fig. 8, the plate 48 is provided in its central part with an opening 60 corresponding to the width of the key 56 whereas two lateral noses 61, 62, independent from each other, serve as contact points to the ramps of the keys 63, 64, shown in Figs. 8a and 8b.

Key 63 which would be the individual key, is provided on its right hand flank with a groove 65 the upper and lower edges of which constitute the upper ramp 66 and the lower ramp 67. This latter makes contact with all the right hand noses of the plates 48 whereof the springs 50 are arranged according to Fig. 8, that is, above the rods 57. The upper ramp 66 makes contact with the right hand noses of the plate, the springs of which have been arranged at the opposite side. The form of the ramps 66 and 67 on the length of the key 63 is such, that, when this latter is fully inserted into the cylinder, it thrusts on the right hand noses 61 of all plates and brings them again inside the cylinder. The key moreover is provided on its left hand flank with a recess 68 which extends nearly its total length. This recess is arranged in such a way that the key 63 can be introduced into the lock without making contact with any of the left hand noses on the second key 64 which might represent a master-key.

This is also the case for this second key 64 on which both ramps viz. the upper one 69 and the lower one 70, come into contact with the left hand noses of all the plates and bring them back, inside the cylinders whereas its right hand flank is provided with a recess, the object of which corresponds to that of the recess 68 of the key 63.

Figs. 9 to 15 illustrate variations of the shape of the plates and the profile of the corresponding keys of the lock shown in Fig. 8.

On plate 71 of Fig. 9 the noses 61 and 62 are replaced by recesses 72 and 73 and the corresponding keys 74, 75, Figs. 9a and 9b are each provided, on one of their sides, with a projecting part 76, 77, which penetrates into one of these recesses and of which the upper edges 78, and lower edges 79, constitute the working ramps. The contact points of plate 80 shown in Fig. 10 are located on the noses 81, 82, which, instead of being situated on each side of the opening 83, are superimposed and located on the same side of this opening. The top nose 81 makes contact with ramps 84 and 85 of the key 86 (Fig. 10a) provided with a double groove, whereas the ramps 87 and 88 of the key 89 (Fig. 10b) which is provided with a groove make contact with the bottom-nose 82 of the plate 80.

Figs. 11, 11a, 11b show the reverse solution; the noses being replaced in the plate 90 by recesses 91 and 92 and the grooves of each key by projecting parts 93, 94.

In the preceding examples of Figs. 8 to 11, the working ramps are located on the sides of the key. As pointed out in Fig. 8, the key 56 is guided by its upper and lower edges 95, which are rectilinear and parallel, in the opening 55 provided in each plate 54.

On the other hand, in the following examples shown in Figs. 12 to 15, the working slopes are cut directly on the upper and lower edges of the key. The key can thus guided, either according to Fig. 12, by grooves 95 working on the noses 96, located, according to Fig. 15 at both sides of the

axial opening of the plates composing the cylinder, or, inversely, by lateral projecting parts penetrating into corresponding recesses of the plates. Thus, in the locking element **97** shown in Fig. 12, the bottom of the slot **98** can serve for contact with the ramp **99** of the key **100** (Fig. 12*a*), whereas the upper edge **101** of the key **102** (Fig. 12*b*) makes contact with the plate **97** by the shoulder **103**. The lower edges **104** and **105** of the keys **100**, **102**, constitute the working ramps for the plates which lock the cylinder in the opposite direction. The edges of these keys can be crossed in order to allow a better guiding of the key into the cylinder. The plate **106** shown in Fig. 13, is provided in order to make contact with the ramps **107** of the key **108** (Fig. 13*a*) with two shoulders **109**, whereas the ramp **110** of the key **111** (Fig. 13*b*) makes contact with the bottom of the slot **112**.

Figs. 14, 14*a*, 14*b* show the reverse arrangement.

In the lock device shown in Fig. 8, the plates work in a well determined direction, which, for each of them depends on the chosen position for the assembling of the push springs. It would therefore be quite sufficient for each plate to present working points for only one direction.

However, with a view of cutting costs, it is possible to reduce to one-half the number of standardised patterns necessary for manufacturing plates each of which can be used for two different possible combinations of the working points and which can be chosen as wanted in assembling these plates in the one or in the reverse direction. This arrangement has been adapted in the examples illustrated by Figs. 8 to 15.

In all examples given in this description, the locking elements have been represented with distinct working points for two different keys. It is however well understood, that the same elements can be arranged with the necessary working contact points or to a larger number of different keys.

Constructional details may vary without departing from the scope of the subjoined claims.

What is claimed is:

1. Safety-lock comprising a lock body with a bore therein, a cylinder rotatable in said bore, said cylinder being formed of a pile of discs provided with aligned longitudinal openings forming the keyhole of the lock, locking elements guided between the back of one disc and the walls of a diametral recess in the front of the next disc, said elements being movable transversely in the cylinder between an unlocking position and a locking position preventing rotation of said cylinder, springs biasing said locking elements to locking position, means in the keyhole opening of the cylinder for preventing transverse motion of the key under the action of the locking elements, and a plurality of means on each locking element, each means being adapted to cooperate with a different key to move said elements against the action of the springs to unlocking position.

2. Safety-lock according to claim 1 wherein each locking element is in the form of a plate with a keyhole opening and is provided with at least two key-contact surfaces located at different heights in the side walls of its keyhole opening, each of these surfaces cooperating with a different key for bringing the locking elements in the unlocked position of the cylinder.

3. Safety-lock according to claim 1 wherein the recessed discs constituting the cylinder are connected by rods traversing the pile of discs, said rods forming abutments for the springs.

4. Safety-lock according to claim 1 wherein the recessed discs constituting the cylinder are connected by two rods traversing the pile of discs, said rods forming stops for the locking elements.

5. Safety-lock according to claim 1 wherein each locking element is constituted by a plate, the largest dimension of which corresponds to the diameter of the cylinder and having both its ends flush with the outer form of this latter when the plates are in their unlocked position, said plate being provided on both its opposite side faces with a recess limited in the direction of its length by opposite ledges between which said springs and connections for the pile of discs are arranged, one of the ledges forming an abutment for the spring and the other ledge cooperating with one of said connections to limit the displacement of the locking element.

6. Safety-lock comprising a lock body with a bore therein, a cylinder rotatable in said bore and having a longitudinal opening forming the keyhole of the lock, a plurality of spring pressed plungers slidable in transverse bores in said body, a plurality of locking pins of cross section similar to that of the plungers and slidable in bores in said cylinder which are aligned with the transverse bores of the cylinder when the latter is in locking position, said locking elements projecting at their inner ends into the keyhole opening and being provided there with a plurality of spaced key contact surfaces each adapted to cooperate with a different key to enable said plungers to follow said locking elements partly into the bores in said cylinder to lock the same when said bores are aligned as aforesaid, and means for preventing transverse movement of the key in the keyhole under the influence of the spring pressed plungers and locking elements.

7. Safety-lock according to claim 6 in which the locking elements are formed with stubs at their inner ends, the points of said stubs forming contact surfaces for one key and the shoulders between the stubs and the elements forming the contact surfaces for a different key.

8. Safety-lock according to claim 6 in which the transverse bores in the lock body and cylinder form continuous longitudinal parallel walled slots extending through to the keyhole opening, and the plungers and locking elements are of rectangular cross section substantially filling said slots with each plunger and element in direct contact with the adjacent plunger and element along the slots.

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