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(54) PIN-TUMBLER SAFETY LOCK DEVICE AND PROCESS AND DEVICE FOR PRODUCING SAME

(71) We, NEIMAN S.A., a French Body Corporate, of 39 Avenue Marceau, Courbevoie, France do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to pin-tumbler safety lock devices.

Known pin-tumbler lock devices comprise a fixed part or stator provided with an axial cavity in which a rotary member or rotor is journalled. The rotor contains radial bores aligned along a generatrix and opening onto a longitudinal slot for receiving a key. Disposed in these bores are cylindrical pins which co-operate with coded notches of the key, each pin having such length that, with the correct key in position, the end of each pins opposite to that engaged with the key is exactly flush with the outer surface of the rotor.

The stator has a series of radial bores which are aligned in the longitudinal direction and open onto the cavity in which the rotor is journalled. Each of these radial bores contains a cylindrical pin of the same diameter as the pins of the rotor and a spring which biases the pin toward the rotor.

In one angular position of the rotor, the bores of the rotor are in alignment with the bores of the stator. In the absence of the key, the pins of the stator, biased by their respective springs, urge the pins of the rotor toward the centre and partly penetrate the bores of the rotor which is thus locked against rotation. It is only with the correct key that the pins of the rotor can be brought into a position in which they are flush with the surface of the rotor so as to release the rotor.

These known pin tumbler lock devices have a complicated construction and are expensive. The pins are produced by a turning operation and the bores in the stator and rotor are machined or calibrated. In automatic assembling machines, the pins are distributed by means of numerous vibrating bowls or stored after degreasing in tubes of plastics material. The moulds for producing the stators and rotors are fragile and require considerable maintenance. Owing to their complication, these parts themselves are delicate to produce and present many problems of burring. Moreover, the errors of combination between keys and the lock device are frequent, since the keys are notched independently of the production of the lock device.

Further, in order to obtain a constant load on the pins of the rotor, which prevents detecting the combination by feel, pin pairs are often employed, the total length of which is constant, and this multiplies the number of different pins. Note also that the tolerances required for the movements of the pistons in their bores and for the release of the rotor adversely affect the precision of the lock device.

An object of the present invention is to overcome the drawbacks of known pin tumbler lock devices by means of a new lock device the production on which is simplified and capable of being rendered automatic in synchronism with the notching of the keys, the new lock device being cheaper and more precise than the known pin tumbler lock devices.

According to the invention there is provided a pin-tumbler type safety lock device comprising a cylindrical rotor journalled in a cavity of a stator, said rotor containing a plurality of radially slidable pins for cooperation at their inner end with the notches of a key for bringing their other end flush with the periphery of said rotor, said other end being aligned with the inner surface of the cavity in which the rotor is journalled on insertion of a correct key and, for one angular region of the rotor, engageable against pins slidable in cavities in the stator and biased toward the rotor by springs with retaining means therefore, wherein said pins of the stator and rotor are flat members, the pins in said stator forming with the pins in said rotor a series of pair of pins, the number of pairs being equal to the number of notches in said key,

each pair being formed from one flat blank, the overall height of each pin pair being substantially identical to the height of the other pins pairs, said pins being disposed respectively in a single slot of the stator and in a single slot of the rotor and having rectilinear and parallel lateral edges which are in contact with the lateral edge of an adjacent pin or the end of said slot.

The use of flat blanked pins permits a simplification of the production of the pins and the obtainment, in the course of the notching of the key of the lengths corresponding to the desired combination. The mounting of the pins with their edges adjoining in a single slot of the rotor or stator permits a considerable simplification of these cast parts and their production.

Another object of the invention is to provide a process and device for producing the aforementioned lock device.

The invention will be understood from the ensuing description with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a flat member employed for forming a couple of pins,

Figures 2 and 3 are respectively perspective views of two pairs of pins obtained from members such as is shown in Figure 1,

Figure 4 is a plan view of a portion of a prestamped strip for producing members according to Figure 1,

Figure 5 is a longitudinal sectional view of a lock device according to one embodiment of the invention,

Figure 6 is a diametral sectional view of the lock device shown in Figure 5, the key, the pins and the springs having been omitted,

Figure 7 is a top plan view of the stator of the lock device shown in Figures 5 and 6, some of the parts of which have been omitted to render the drawing clearer,

Figure 8 is a plan view of the rotor of the lock device shown in Figures 5 and 6,

Figure 9 is a diagrammatic plan view of a machine for producing lock devices according to Figures 5 and 6, and

Figure 10 is an elevational view of a part of the machine shown in Figure 9.

Figure 1 shows a flat member 1 having two parallel lateral edges 2 and 3, a pointed end 4 and a notch 5 in its upper part.

By shearing along a line perpendicular to the edges 2 and 3, the blank 1 is divided into two pins $1'$ and $1''$ (Figure 2) or $1'_1$ and $1''_1$ (Figure 3), the sum of the lengths of which is constant and which correspond to two different depths of notches of the key.

The pins $1''$ and $1''_1$ are adapted to be disposed in the rotor 6 of the lock device (Figure 5), the points 4 cooperating with the notches 7 of the key 8. The pins $1'$ and $1'_1$ are adapted to be disposed in the stator 9 of the lock device and the notches 5 receive coil springs 10.

Instead of being produced in advance and stored, the blanks 1 may be pre-stamped in a metal strip 11 (Figure 4) which may be stored on a reel and fed directly to a lock device producing machine. The blanks 1 are connected to the strip 11 by strip portions 12 which are sheared at the same time as each member 1 is blanked into two pins.

For receiving of pins $1''$, $1''_1$ and $1''_2$, etc, the rotor 6 has a longitudinal slot 13 (Figure 8) in which the pins are disposed side-by-side, the lateral edges 3 of each pin being guided by a lateral edge of a neighbouring pin or, in respect of the end pin, by an end of the slot 13.

Likewise, the stator 9 has a longitudinal slot 14 (Figure 7) in which the pins $1'$, $1'_1$, and $1'_2$ etc are disposed in the same manner as before. Cavities 15 are formed in the base of the slot 14 for receiving the springs 10. The cavities 15 open onto the exterior of the stator 9 and are closed by a common cover 16 (Figure 5) which retains the springs 10.

It can be seen that the production of the rotor and stator, which are cast parts, is greatly simplified when the independent bores containing the pins are replaced by a single slot.

The lock device just described lends itself particularly well to a production carried out at the same time as the notching of the corresponding key or keys so that any subsequent risk of error is avoided. One embodiment of such a machine for assembling the lock device and simultaneously notching keys is shown diagrammatically in Figures 9 and 10.

The machine comprises two main elements, namely a key notching element and a lock device assembling element. These two elements are interdependent and their movements are synchronized.

The key notching element, known *per se*, comprises a transverse carriage 17 carrying a punch 18 for the cutting of the notches on the key 8, and an axial carriage 19 which determines the spacing of the notches. The movement of the carriage 17 is controlled by a cam 20 and the movement of the carriage 19 by a cam 21.

The element for assembling the lock device comprises a transverse carriage 22 connected to the carriage 17 by a rod 23 and an axial carriage 24 actuated by a cam 25 keyed on a shaft 26 on which the cam 21 shifting the carriage 19 is also keyed. Consequently, the carriage 22 is subjected to movements which are identical to those of the carriage 17 and the carriage 24 undergoes movements which are identical to, or synchronized with, those of the carriage 19.

The carriage 22 carries a magazine 27 (Figure 10) which feeds flat blanks 1 (or strip) which are fed one-by-one by a pusher blade 28 shifted by a ram 29 or any other suitable device. The blanks 1 fed by the blade 28 are cut into stator and rotor pins by a punch 30 carried by the carriage 24, the synchronization of the movements of the carriages 17

and 22 automatically ensuring the identity of combination of the notch cut into the key 8 by the punch 18 and the pins cut from the member 1 by the punch 30.

The separated pins are introduced into the stator 9 and rotor 6 of the lock device which is carried by a rotary drum 31 provided with receiving recesses 32. After introduction of the suitable number of pairs of pins, the drum 31 brings the lock device to a station 33 where the springs 10 are placed in position. A further rotation of the drum 31 brings the lock device to a station 34 where the spring retaining cover 16 is mounted and, after a further rotation of the drum 31, the finished lock device is discharged at a station 35.

WHAT WE CLAIM IS:

1. A pin-tumbler type safety lock device comprising a cylindrical rotor journalled in a cavity of a stator, said rotor containing a plurality of radially slidable pins for cooperation at their inner end with the notches of a key for bringing their other end flush with the periphery of said rotor, said other end being aligned with the inner surface of the cavity in which the rotor is journalled on insertion of said key and, for one angular region of the rotor, engageable against pins slidable in cavities in the stator and biased toward the rotor by springs with retaining means therefore, wherein said pins of the stator and rotor are flat members, the pins in said stator forming with the pins in said rotor a series of pair of pins, the number of pairs being equal to the number of notches in said key, each pair being formed from one flat blank, the overall height of each pin pair being substantially identical to the height of the other pin pairs, said pins being disposed respectively in a single slot of the stator and in a single slot of the rotor and having rectilinear and parallel lateral edges which are in contact with the lateral edge of an adjacent pin or the end of said slot.

2. A lock device as claimed in claim 1, wherein the pins of the rotor have a point.

3. A lock device as claimed in claim 1, wherein the pins of the stator have a notch provided for receiving a spring.

4. A lock device as claimed in claim 1, wherein the slot in the stator has formed therein said cavities for receiving said springs, which cavities open onto the exterior of said stator.

5. A process for producing a lock device as claimed in claim 1, comprising feeding a pre-stamped strip of flat pin members or a series of flat pin members of uniform length to a device for dividing said members in turn along a line related to the depth of the notch to be made in the key, dividing each member into a pair of pins the lengths of each pin being related to the depth of the corresponding notch of the key, feeding said pin pairs edge to edge into a stator and a rotor of a lock device each of which is provided with a receiving slot having rectilinear and parallel lateral edges, providing pin pairs equal in number to the number of notches in the key, placing return springs into cavities in said stator for said pins to abut the pins within said stator, and fitting retaining means for holding said pins within the stator and rotor.

6, Apparatus for carrying out the process as claimed in claim 5, comprising means for supporting a stator and rotor assembly of a lock device, a first punch-carrying carriage movable in a first direction, a second key-carrying carriage movable transversely to the first direction, a third movable carriage connected to move in the first direction together with said punch-carrying carriage, a fourth movable carriage movable in said first direction together with the movement of said second key-carrying carriage, means for feeding a series of flat pin members or a strip of pre-stamped flat members to said fourth carriage, a punch movable together with said fourth movable carriage and operable to divide each pin blank transversely thereof along a line relative to the depth of the respective notch of the key, means for inserting the divided portions forming a pin pair into aligned slots in the stator and rotor in turn as the first carriage effects a traverse, means for providing springs in the slot to engage respectively the pins within the stator, and means for providing retaining means for holding said pins and springs within said stator and rotor.

7. A device as claimed in claim 6, wherein the means for supporting a stator and rotor assembly comprise one recess of a series of recesses formed in a drum rotatable intermittently through operational stations.

8. A lock device as claimed in claim 1, substantially as described herein with reference to and as illustrated by the accompanying drawing.

9. A process as claimed in claim 5, substantially as hereinbefore described.

10. Apparatus as claimed in claim 6, substantially as hereinbefore described.

FOR THE APPLICANTS:

MATTHEWS, HADDAN & CO.,
Chartered Patent Agents
Haddan House
33 Elmfield Road,
Bromley,
Kent.

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1572651 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

Fig. 1

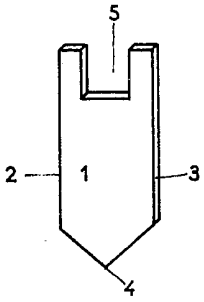

Fig. 2

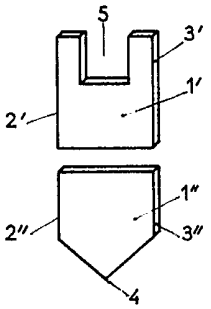

Fig. 3

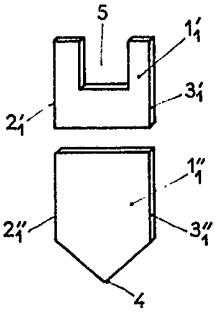

Fig. 4

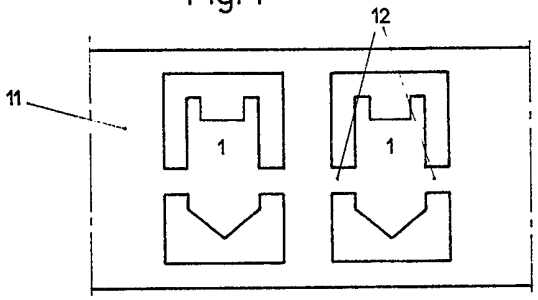

Fig. 5

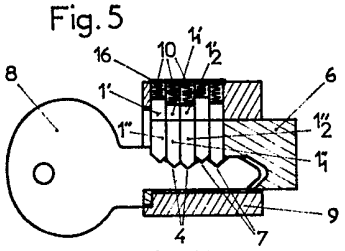

Fig. 6

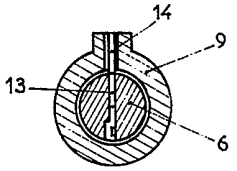

Fig. 7

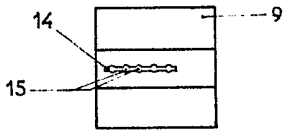

Fig. 8

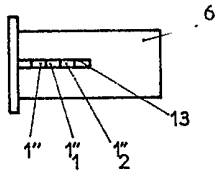

Fig. 9

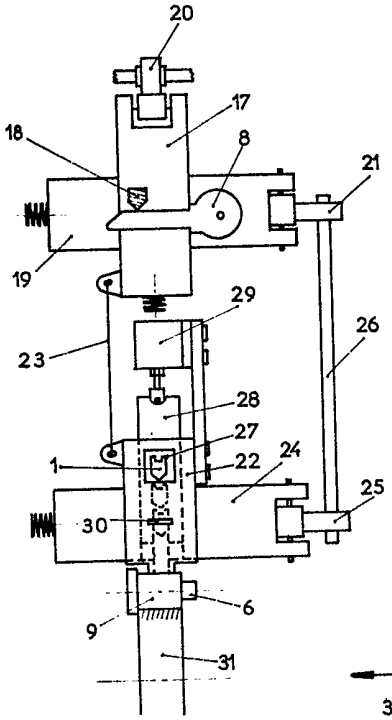
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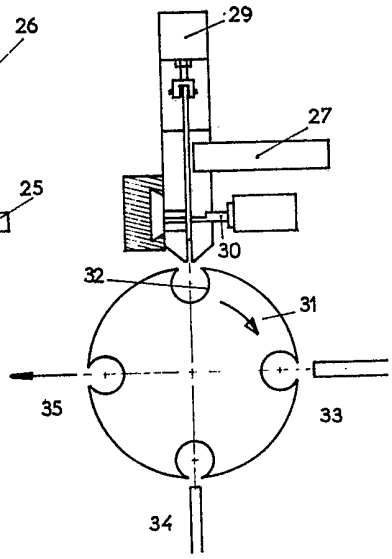
Fig. 10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