UNIVERS STATES PATENT OFFICE.

FRANK SCHARA, OF KANSAS CITY, MISSOURI, ASSIGNOR TO SCHARA MANUFACTURING CORPORATION, OF KANSAS CITY, MISSOURI.

PERMUTATION-LOCK CONSTRUCTION.

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To all whom it may concern:

Be it known that I, FRANK SCHARA, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Permutation-Lock Constructions, of which the following is a specification.

The invention has for an object to effect an improvement in permutation locks employing rotating tumblers on a sliding bolt, and has been particularly applied successfully in small padlocks.

It is a purpose to improve the functioning of such locks by obviating liability of damage because of undistributed stress on tumblers, and also to minimize liability of discovery of a combination by observation of movements or sounds in the lock.

Additional objects, advantages and features of invention reside in the construction, arrangement and combination of parts as will be understood from the accompanying particular description and drawings, wherein—

Figure 1 is an elevation of a lock embodying my invention; Figure 2 is an edge view thereof at the side with the tumblers; Figure 3 is a view of the shackle detached; Figure 4 is a longitudinal section of the lock; Figure 5 is a bottom view of one of the tumblers; Figure 6 is a similar view showing the shackle body without the ward ring; Figure 7 is a similar view of the ward ring detached; Figure 8 is an end view of the shackle bolt; Figure 9 is a top view of the lock body; Figure 10 is a cross section of the shackle bolt; Figure 11 is an elevation thereof from the back of Figure 3.

There is illustrated a case body 10 substantially rectangular in side elevation and formed with a plurality of stalls or openings 11 in one edge to receive and partly support rotatable tumblers, and this provides separating plates 12 between the tumblers. Before or after formation of these stalls a bore 13 is formed through the projection 14 of the body, through the plates 12, and part way into the bottom projection 15, the top and bottom projections being shaped and aligned with the plates 12. A circular recess 16 is formed in the top edge of the body 10 of the same diameter as the bore 13 and this recess is bushed with a metal 17 to a minimum degree to corrosion to receive the bill or extremity 18 of the swinging hook-shaped shackle 19, which is formed with an elongated arm or bolt portion 20.

The bolt 20 is much less in diameter than the bore 13, and is fitted in a sleeve or jacket 21 of brass or other metal liable in a minimum degree to corrosion. The bolt body is cylindrical in cross section, and formed with screw threads at its lower end. The sleeve 21 is internally threaded at its lower part, receiving the end of the bolt in tight screw relation therewith. The threads of the sleeve must therefore project inwardly from the sleeve beyond the projection of the unthreaded portion of the bolt. The sleeve and bushing 17 are of the same material and diameter and are preferably formed from seamless tubing, the threads of the sleeve being formable by compression onto a suitable die to provide the inwardly projecting threads.

The shackle and sleeve of the bolt portion are formed so that in locked position, the sleeve fits in the bore within the bottom projection 15 and at the opposite end is flush with the top surface of the body 10, while the bill 18 of the shackle is set securely in the recess 16.

A flat 22 is formed on the sleeve which stops short of the top of the body 10 when the parts are in locked position, and extends downwardly a distance equal to the movement necessary to disengage the bill 18 from the recess 16, and a retaining pin 23 is engaged through the body 10 close beside the flat 22. Coincident with the lower terminal portion of the flat 22 a circumscripta groove 24 is formed around the sleeve to permit free swinging of the shackle when at the outer limit of its movement, permitting the pin to move thereinto. In registry with each of the stalls 11 circumscripting grooves 25 and 26 are formed on the sleeve, and in the present instance, these grooves are closely
adjacent the lower sides of the stalls and preferably flush therewith when the shackle is in locked position. A longitudinal groove 25 also extends from the extremity of the sleeve to the uppermost groove 28, of the same depth as the grooves 25 and forming communication between them.

Tumblers 27 are revolvably engaged in the stalls, receiving the bolts slidably therein, the tumblers having suitable characters on their perimeters. Each tumbler comprises a circular or other form of body 28 having a central bore 29 through which snugly fit the bolt for ready sliding movement therethrough through the body and for easy rotation of the body of the bolt. Each tumbler body part is also formed with a circular recess 30 in the lower side concentric with the bore 29, and having numerous notches or branches 31 stopping short of the lateral face or faces of the body 28. These notches are V-shaped in the present instance, giving the recess a star-shaped appearance. The bottom of the recess is as nearly planiform as practicable. Fitted tightly in the recess there is a ward washer or ring 32 having one or more points 33 on its periphery adapted to engage the notches 31 alternately, and having an inwardly projecting ward lug 34 formed integrally thereon. These washers are stamped integrally from sheet metal, all of the same form, size and shape, and are pressed into the recesses in various relations to the characters on the perimeters of the tumblers, so that various combinations may be developed. The notches 31 are arranged in a definite relation to the characters on the tumblers, and preferably they are uniformly spaced, so that when the lugs of all tumblers are aligned longitudinally of the bolt the characters will likewise be aligned. The lugs are of a form to move freely into the longitudinal groove and the circumscribing grooves of the bolt.

The body 10 of the lock includes planiform faces 35 on the side adjacent the tumblers, there being three between the two major surfaces or sides of the body 10. The faces 35 and the sides are in the relation of five consecutive sides of a symmetrical octagon having the bolt as its axis and the tumblers are preferably cylindrical and formed with a radius equal to that at the apices of the angles between the faces 35. In this way the faces of the tumblers project readily for manipulation without affording room for excessive accumulation of matter tending to foul the lock.

The inner sides of the stalls are set well back from the tumblers at the sides of the body so that ready grip on the tumblers may be obtained for a considerable distance.

The characters on the tumblers are preferably raised so as to further improve the grip of the fingers thereon during manipulation. While eight characters and notches 31 are shown, this number may be varied as found desirable.

The method of forming the body 28 consists in providing rod stock of the proper size, cutting this into segments to form bodies 28, punching the bore 29, stamping the recess 20 by a suitable die, refinish the bore 29, and forming the characters on the perimeter after familiar practice. The characters may be formed on the rod stock if preferred, by drawing the rod between rollers having the desired characters thereon and bearing upon the rod with sufficient pressure.

The assembly of the sleeve 31 and bolt 20 is accomplished by forming the parts to fit snugly one over the other, and then heating the sleeve and screwing the bolt quickly thereinto. The sleeve will then shrink on to the bolt firmly against casual removal. Other methods may be found applicable within the scope of the invention.

In the use of this lock the strength of steel in a small sized shackle to resist damage and distortion by abuse may be availed of, while at the same time the advantage in brass and other non-corrosive metals in reducing liability of the parts rusting together is availed of. The location of the washers 32 at the lower side of the tumblers insures that the stress incident to attempts to force the lock will be sustained in such a manner that liability of displacement of the parts from proper operative relation will be minimized, and also the parts will be arranged in the best manner to sustain the maximum stress without strain or failure.

The partition plates 12 are resilient in the ordinary materials used in such locks, and while adapted to sustain a considerable stress without flexure, on application of maximum stress they will yield slightly, so that all of the tumblers and interposed plates become adjusted to a load, and each of the lugs 34 in the grooves 25 will be enabled to assume a portion of the stresses communicated from the bolt when pulled upon at the shackle. It may be found desirable to provide a slight additional play between the uppermost tumbler and the sides of its stall, in order to enhance the functioning of the parts as last mentioned, and in addition to permit a binding of the partition plates on the bolt and thereby sustaining exceptional stresses directly. This would minimize liability of damage to the tumbler parts and grooves of the bolt.

It will be noted that each groove 25, at its lower side is formed with a series of notches 30 corresponding in width and depth to the groove 26, but of slight extent longitudinally of the bolt. These serve as foils in case an attempt is made by an unauthorized person to determine the proper positioning of the
tumblers by sounds in the lock or the sense of touch. They may be arranged in longitudinally aligned series, or may be irregularly spaced.

I claim:

1. In a lock of the character described, a case having a bolt receiving bore and stalls transversely thereof to receive rotating tumblers, a bolt portion slidable in said bore, tumblers in said stalls snugly revoluble on the bolt, means on bolt and tumblers to interlock at certain positions of the tumblers but permitting sliding movement of the bolt at other limited positions, the material of the case between the stalls comprising resilient plates projecting between the tumblers adapted to sustain considerable stress individually but yieldable to equalize stresses on the tumblers.

2. The article of claim 1 in which the stalls are located on the case in a relation to form therebetween resilient plates the said bore being continued through the plates and snugly fitting the bolt, and in which the tumblers and a shackle engage in a manner to transmit stresses incident to longitudinally applied force from the bolt to the plates and cause inclination thereof to bind on the shackle.

In testimony whereof I affix my signature.

FRANK SCHARA.